ENVIRONMENTAL ASSESSMENT UPDATE
AND SECTION 404(b)(1) REVIEW FOR
MAINTENANCE DREDGING OF

# NORTH COVE

## OLD SAYBROOK, CONNECTICUT

1984

**US Army Corps of Engineers**
New England Division

# ENVIRONMENTAL ASSESSMENT

## UPDATE
## AND SECTION 404(b)(1) REVIEW FOR
## MAINTENANCE DREDGING OF NORTH COVE

## OLD SAYBROOK, CONNECTICUT


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## FINDING OF NO SIGNIFICANT IMPACT

Factors considered include the effects of dredging the channel and the anchorage of North Cove and the effects of disposal of the dredged material at the Cornfield Shoals disposal site in Long Island Sound. Bioassay and bioaccumulation tests were conducted. Evaluation of these tests indicate that there should be no unacceptable environmental impacts and that the Section 103 Ocean Dumping regulations of the Marine Protection, Research and Sanctuaries Act of 1972 (applicable to Long Island Sound) have been satisfied for disposal of dredged material at the Cornfield Shoal site.

This assessment has been prepared in accordance with the National Environmental Policy Act of 1969. My determination that an Environmental Impact Statement is not required is based on the information contained in the Environmental Assessment and the following considerations:

1. The loss of benthic communities and the generation of suspended material at the dredging and disposal sites would be minimal and would not cause sustained or substantial impact to the ecological integrity of the region's aquatic resources; there are no productive shellfish beds either in the cove or at the disposal site.

2. The proposed plan would not involve wetlands, or affect any endangered species, cultural resources or commercially important shellfish populations;

3. Ocean dumping criteria have been satisfied for disposal of the dredged material at the Cornfield Shoal, Disposal Site, and;

4. Coordination with appropriate Federal and state agencies insured that concerns and suggestions were made known to the Corps so that these concerns could be considered.

There does not appear to be any major environmental problem, conflict or disagreement in implementing the proposed work. I have determined that implementation of the proposed action would not have a significant impact on the human environment and that it does not constitute a major Federal action requiring the preparation of an Environmental Impact Statement.

After careful consideration of the information in this Environmental Assessment, it is my conclusion that development of the proposed project would not require a significant commitment of physical, natural or human resources.

16 MAR '84
DATE

CARL B. SCIPLE
Colonel, Corps of Engineers
Division Engineer

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## ATTACHMENTS

1. 1975 and 1983 Sediment Gradation Curves for North Cove.

2. May 1976 Environmental Assessment on the Proposed Maintenance Dredging of North Cove, Old Saybrook, Connecticut and Brockway Bar and Essex Shoal, Connecticut River, Connecticut.

3. DAMOS-Disposal Area Monitoring System, Annual Data Report - 1978, Supplement G, Cornfield Shoals Disposal Site, May 1979.

## TABLES

## I. Introduction

This assessment updates the May 1976 Environmental Assessment for the Maintenance Dredging of North Cove, Old Saybrook, Connecticut, and Brockway Bar and Essex Shoal, Connecticut River, for the North Cove segment of that assessment. Together with the attached documents it serves to review and assess the impacts of the proposed maintenance project for North Cove.

## II. Need for Proposed Action

North Cove provides safe anchorage and mooring for about 150 vessels and has had more demand for mooring space than it can provide since 1972. The vessels using the harbor are predominantly recreational craft, the majority of which are sailboats with drafts between four feet and six-and a half feet.

Natural tidal action and riverine flow causes deposition of sediments in North Cove and its entrance channel to the Connecticut River. Periodic maintenance dredging is required to keep the entrance channel and anchorage open and usable for their authorized (Section 107, 1960 River and Harbor Act) purpose. The project was originally constructed in 1965, and last maintained in 1977 when 100,000 cubic yards of shoaled materials was dredged and disposed of at the Cornfield Shoal Disposal Site. The North Cove entrance channel and first anchorage area have an authorized depth of 11 feet at Mean Low Water (MLW), while the second anchorage area is authorized to 6 feet MLW. User vessel characteristics, however, dictated that the depths in channel and first anchorage be maintained to only 8 feet and that the authorized 6 feet depth be maintained in the second anchorage. Presently, shoaling in North Cove has created depth restrictions to 4 feet MLW. An Environmental Assessment was prepared to assess the 1977 maintenance dredging activities and has been attached to this update for documentation and reference. (Environmental Assessment: Proposed Maintenance Dredging of North Cove, Old Saybrook, Connecticut and Brockway Bar and Essex Shoal, Connecticut River, State of Connecticut, May 1976).

## III. Proposed Action

The U.S. Army Corps of Engineers proposes to dredge approximately 75,000 cubic yards of predominantly fine sands, sandy silt and silt (0.2-0.01 mm) from the entrance channel and the anchorage of the Federal navigation project in North Cove. The Cove is a 150 acre embayment located on the west side of the Connecticut River and separated from it by an abandoned railroad embankment. The cove's inland boundaries are bordered by tidal marsh.

The shoaled material would be excavated by a bucket dredge and placed in scows for disposal at the Cornfield Shoals Disposal Site in Long Island Sound. The Town of Old Saybrook had expressed an interest in using about

2,000 cubic yards of the sandy materials for fill at an upland site of a new historic park. The high costs to transport and handle the materials, however, has prompted the town to dismiss that option. The dredging is proposed to begin in March or April 1984, and would take approximately one month to complete.

In addition to the Corps' proposed project, the North Cove Yacht Club anticipates dredging approximately 700 cubic yards of shoaled material from their mooring area in the cove. This dredging would also be for maintenance purposes; shoaled materials to be removed would most likely be similar in physical and chemical characteristics to those in the Federal project. This activity would require a review by the Corps of Engineers for a regulatory permit. A second project planned at North Cove is a private local project by Mr. Robert Foisie who has proposed to remove about 7,000 cubic yards of materials from an area never before dredged. This project would require a Corps' permit and will require a separate environmental review.

## IV. Affected Environment

The 1976 Environmental Assessment should be referenced for principal background information. The area surrounding North Cove is primarily salt marsh and residential property. Industrial development has been kept to a minimum without any major or heavy industry. The cove is small with a surface water area of only about 150 acres. Water movement in and out of the cove, as well as navigational access, is restricted by an abandoned railroad embankment separating the cove from the Connecticut River. The cove's enclosed setting and low upland inflow create a low energy hydraulic system. The cove tends to serve as a settling basin for sediment entering from the higher energy Connecticut River or upland run-off.

Water quality in North Cove carries an SCC designation which is suitable for fish, shellfish and wildlife, recreational boating and industrial cooling. The cove has a history of coliform bacteria presence, but not enough (70-400 organisms/100 ml) to close any beaches or to be substantively different from counts reported for the mouth of the Connecticut River which averages 353 organisms /100 ml. (Connecticut State Department of Health - 1975 Bathing Beach Study).

Analyses of the Cove's bottom sediments were made for the 1976 Assessment and again for the proposed work. Sediment analyses indicate that the material in North Cove consists of sandy-silt, silty-fine sand, sand, organic debris and shell fragments. Sediments in the cove area are basically organic silts grading to sandy silts and silty fine sands. Reducing conditions existed in the cove during the Corps sampling as indicated by visual observations and the presence of strong anoxic marine odors. The physical and chemical bulk sediment analyses results are presented in Table 1 for 1975 and in Table 2 for 1983. The sediment gradation curves are included as Attachment #1.

Table 1

1975 BULK SEDIMENT ANALYSIS*

| Parameter | PE-1 0.0' - 0.17' | PE-1 1.0' - 1.17' | PE-2 0.0' - 0.17' | PE-2 1.0' - 1.17' | PE-3 0.0' - 0.17' | PE-3 1.0' - 1.17' |
|---|---|---|---|---|---|---|
| % Oil - Greease | 0.35 | | 0.25 | | 0.33 | |
| % Volatile Solids | 6.5 | | 2.6 | | 7.0 | |
| % Water | 63.3 | 59.6 | 47.9 | 52.3 | 66.6 | 66.0 |
| % Silt-Clay | 98.2 | 98.2 | 52.1 | 67.1 | 97.9 | 97.9 |
| Mercury (ppm) | 0.39 | 0.58 | 0.18 | 0.43 | 0.44 | 0.43 |
| Lead " | 98.0 | 97.0 | 75.0 | 77.0 | 72.0 | 106.0 |
| Zinc " | 246.0 | 246.0 | 129.0 | 203.0 | 270.0 | 259.0 |
| Arsenic " | 7.3 | 6.5 | 3.5 | 3.8 | 6.0 | 6.8 |
| Cadmium " | 8.7 | 7.7 | 4.2 | 6.1 | 6.0 | 5.9 |
| Chromium " | 87.0 | 97.0 | 46.0 | 69.0 | 96.0 | 106.0 |
| Copper " | 142.0 | 126.0 | 58.0 | 76.0 | 108.0 | 106.0 |
| Nickel " | 65.0 | 58.0 | 42.0 | 38.0 | 72.0 | 59.0 |
| Vanadium " | 54.0 | 48.0 | 42.0 | 38.0 | 60.0 | 59.0 |
| PCB (ppb) | 80.0 | | | | | |
| DDT (ppb) | < 0.007 | | | | | |

* Environmental Assessment, Proposed Maintenance Dredging Of North Cove, Old Saybrook, Connecticut and Brockway Bar and Essex Shoal, Connecticut River, State of Connecticut, May 1976

Table 2

1983 BULK ANALYSIS RESULTS
NORTH COVE, OLD SAYBROOK, CT

| PARAMETER | A | B | C | D | COMP | REF |
|---|---|---|---|---|---|---|
| Soil Class Dom | ML | MH | OH | OH | | OH |
| Soil Class Subdom | MH | | | | | |
| Grain Size Curve-Med | 0.0450 | 0.0250 | 0.0150 | 0.0120 | 0.0500 | 0.7000 |
| Grain Size Curve-Q1 | 0.0850 | 0.0250 | 0.0140 | 0.0170 | 0.1000 | 0.8000 |
| Grain Size Curve-Q3 | 0.0220 | 0.0170 | 0.0140 | 0.0170 | 0.0200 | 0.4500 |
| Grain Size Curve-% Fine | 68 | 97 | 98 | 98 | 63 | <1 |
| Normal/Bimodal | N | N | N | N | N | N |
| Liquid Limit | 50 | 100 | 102 | 106 | 45 | NP |
| Plastic Limit | 31 | 53 | 50 | 55 | 29 | NP |
| Plastic Index | 19 | 47 | 52 | 51 | 16 | NP |
| Spec. Grav. Solids | 2.70 | 2.60 | 2.58 | 2.57 | 2.68 | 2.69 |
| % Solids | 63.8 | 39.11 | 40.91 | 34.5 | 61.7 | 99 |
| % Vol. Sol. NED | 2.75 | 6.69 | 6.93 | 7.09 | 3.06 | 0.16 |
| % Oil & Grease | 0.032 | 0.1220 | 0.0390 | 0.0390 | 0.0700 | 0.0220 |
| Mercury (ppm) | 0.11 | 0.19 | 0.26 | 0.28 | 0.08 | 0.24 |
| Lead (ppm) | 17 | 36 | 35 | 35 | 34 | 2 |
| Zinc (ppm) | 88 | 158 | 149 | 141 | 138 | 23 |
| Arsenic (ppm) 1/ | LI | 4.3 | 7.9 | 2.8 | 7.1 | 2.2 |
| Cadmium (ppm) 2/ | 1 | 1 | 1 | 1 | LI | LI |
| Chromium (ppm) | 23 | 36 | 36 | 35 | 35 | 5 |
| Copper (ppm) | 26 | 51 | 48 | 47 | 45 | 3 |
| Nickel (ppm) 3/ | 26 | 31 | 31 | 22 | 21 | LI |
| Vanadium (ppm) 4/ | LI | LI | LI | LI | LI | LI |
| PCB (ppb) 5/ | LI | LI | LI | LI | LI | LI |
| DDT (ppb) 6/ | LI | LI | LI | LI | LI | LI |

1/ Less than instrument detection level of 1 ppm.
2/ Less than instrument detection level of 1 ppm.
3/ Less than instrument detection level of 10 ppm.
4/ Less than instrument detection level of 100 ppm.
5/ Less than instrument detection level of 5 ppb.
6/ Less than instrument detection level of 2 ppb.

for disposal of the material. It is not possible to predict the exact nature of the material that will be involved.

Because of substantial variations in the nature and volume of material involved in projected dredging and disposal operations, both Federal and private, it is not possible to predict impacts with any precision. In general, future projects are expected to have impacts similar to those of the proposed dredging; this work involves materials which span most of the spectrum, as regards contaminant concentrations and physical characteristics, of materials which may be involved in future disposal operations. Because potential future work involves materials which are expected to vary from essentially clean sands to organic silts, "clean" materials will serve to provide successive "caps" over the more contaminated material. The variability of dredging requirements and availability of funds, both public and private, precludes establishing a definite regimen to that end, but there is a high probability that materials of different characteristics will be alternated to a considerable degree at the disposal site.

## 4.5 Scientific Studies of the Disposal Site and Disposal Effects

This Assessment contains references to a number of reports of investigations into dredged material disposal phenomena. There is a continuing interest in this area of science, particularly by concerned Federal and State agencies and in the universities whose research programs have been supported to a large degree by State and Federal grants. It is conceded that a great deal of scientific research remains to be done. The Corps relies on this continuing research as part of the

use of the nets needed to commercially catch the fish, as well as it is likely to provide cooler waters away from the shallows near the surrounding wetlands.

Several duck species and a few swan pairs use the cove. The dabbling ducks include black ducks, mallards, and teals, and the divers include canvas backs, wigeons, buffleheads and mergansers.

Long Island Sound - Cornfield Shoal Disposal Site

The Cornfield Shoal Disposal Site is principally considered a dispersal disposal site. Fine materials deposited at the site are slowly and eventually dispersed over a larger area by the hydraulic energy over the site. Bottom sediments consist principally of silty sands and sands with some patchy spots of gravel. One survey of the area has been conducted (DAMOS, 1979) and its limited results have characterized the site as having low benthic diversity and low abundance. Predominant species included an Anthozoan sp., Anachis lafresnayi, Lunatia heros, Nassarius trivittatus, and Urosalpinx cinerea. Sampling was also conducted at a reference site about one mile northwest of the disposal site's northwest corner. The predominant benthos species found were Mytilus edulis, Nassarius trivittatus Anachis lafresnay, Crepidula plena, Pherusa affinis, Pagurus longicornis, Echinarachnius parma, Tellina agilis, Unicola irrorata, Amphilpolis squamata. Additional review of the site's aquatic characteristics are presented in the 1976 Assessment and the DAMOS report.

V. Environmental Consequenses

The primary affects associated with the proposed dredging and disposal operation would be related to:

- loss of organisms at the dredging site;

- creation of turbidity (suspended material) at the dredging site;

- release of sediment constituents, such as heavy metals, into the water during disposal operations;

- loss of benthic organisms at the disposal site.

Standard elutriate tests were performed for both the 1977 work and the proposed work using sediments found at North Cove and water from the Cornfield Shoals Dumping Ground. The results for the 1977 work appear in Table 3 and the current 1983 testing results are presented in Table 4. The standards against which the results of the elutriate tests are measured, to assess the materials potential impacts on water quality, are also presented in Table 4. In every case the comparison of results for released constituents into the water was less than its related water quality criteria. To discern the impact that dredging and disposal

Table 3

1975

Standard Elutriate Test, North Cove, Old Saybrook, Conn. and Cornfield Shoals Dumping Grounds. January, 1975.

| Test Property (2) (3) | Water At Dumping Ground (EW-1) | Standard Elutrient Designation and Depths of Sediment Used in Shake Test (1). | | | | | |
|---|---|---|---|---|---|---|---|
| | | North Cove (PE-1) | | North Cove (PE-2) | | North Cove (PE-3) | |
| Depth of Sample | -136.0' | 0-2" | 12-14" | 0-2" | 12-14" | 0-2" | 12-14" |
| Nitrite (N), mg/l | < 0.010 | 0.012 | < 0.010 | 0.010 | 0.011 | < 0.010 | < 0.010 |
| Nitrate (N), mg/l | 0.14 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Sulphate ($SO_4$), mg/l | 1,400 | 1,200 | 1,200 | 1,150 | 1,125 | 1,175 | 1,050 |
| Orthophosphate (P), mg/l | 0.045 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | 0.020 | < 0.010 |
| Total Phosphate (P), mg/l | 0.050 | 0.095 | 0.117 | 0.105 | 0.047 | 0.097 | 0.155 |
| Freon Soluble, mg/l | 1.7 | 4.0 | 0.0 | 3.6 | 3.8 | 10.8 | 0.0 |
| Mercury (Hg), µg/l | 0.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| Lead (Pb), µg/l | < 4 | < 4 | < 4 | 4 | < 4 | < 4 | < 4 |
| Zinc (Zn), µg/l | 26.0 | 17.5 | 18.5 | 20.0 | 12.5 | 11.0 | 9.5 |
| Arsenic (As), µg/l | 3 | 11 | 9 | 9 | 11 | 9 | 11 |
| Cadmium (Cd), µg/l | 3.5 | 1.0 | < 1.0 | 5.0 | 1.0 | 1.0 | < 1.0 |
| Chromium (Cr), µg/l | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| Copper (Cu), µg/l | 13 | 10 | 10 | 15 | 8 | 15 | 10 |
| Nickel (Ni), µg/l | 14 | 14 | 17 | 20 | 23 | 17 | 8 |
| Vanadium (V), µg/l | <8 | <8 | <8 | < 8 | < 8 | < 8 | < 8 |
| Visual Analysis | - | Dark gray organic silt (OL) with marine odor. | | Dark gray organic silty-fine sand (SM) w/marine odor. | | Dark gray organic silt (OL) with marine odor. | |

Table 4

1983 ELUTRIATE TEST RESULTS
NORTH COVE, OLD SAYBROOK, CT

| TEST PROPERTY | DISP SITE WATER | | | A | | | B | | | C | | | D | | | COMP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R1 | R2 | R3 | R1 | R2 | R3 | R1 | R2 | R3 | R1 | R2 | R3 | R1 | R2 | R3 |
| OIL & GREASE (PPM) 1/ | <2.0 | 2.0 | <2.0 | <2.0 | <2.0 | 2.3 | 2.3 | <2.0 | 2.4 | <2.0 | <2.0 | <2.0 | 2.7 | 2.0 | 2.6 | 3.0 | 2.0 | 3.0 |
| MERCURY (PPB) 2/ | 0.5 | 0.5 | 0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| LEAD (PPB) 3/ | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | 4.7 | <2 | <2 | <2 | <2 | 3.6 | <2 | 23.2 |
| ZINC (PPB) 4/ | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 |
| ARSENIC (PPB) 5/ | <1.7 | <1.7 | <1.7 | 7.1 | 5.7 | 8.9 | 31.7 | 23.7 | 34.3 | 10.3 | 12.0 | 14.5 | 34.5 | 38.5 | 3.4 | <1.7 | 1.7 | <1.7 |
| CADMIUM (PPB) 6/ | 1.6 | 1.6 | 1.6 | 2.7 | 2.6 | 2.2 | 3.0 | 2.2 | 1.6 | 4.9 | 2.4 | 5.5 | 4.2 | 1.5 | 0.6 | 1.2 | <0.5 | 3.5 |
| CHROMIUM (PPB) 7/ | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 1.7 | <1 | <1 | 12.9 | <1 | <1 | <1 | <1 | <1 | <1 |
| COPPER (PPB) 8/ | 5.6 | 5.6 | 5.6 | <1.5 | <1.5 | <1.5 | 4.6 | 1.8 | 4.6 | 2.7 | 1.7 | <1.5 | <1.5 | <1.5 | 18 | <1.5 | <1.5 | <1.5 |
| NICKEL (PPB) 9/ | <5 | <5 | <5 | <5 | 5.2 | 10.5 | 16.7 | <5 | 8.0 | <5 | <5 | <5 | 10.4 | 16.6 | 15.6 | 7.9 | 7.0 | <5 |
| PCB (PPB) 10/ | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI |
| DDT (PPB) 11/ | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI | LI |

1/ EPA Water Quality Criteria (1976, 1980) No criteria have been established
2/ EPA Water Quality Criteria (1976, 1980) = 3.7 ppb
3/ EPA Water Quality Criteria (1976, 1980) = 25 ppb
4/ EPA Water Quality Criteria (1976, 1980) = 170 ppb
5/ EPA Water Quality Criteria (1976, 1980) = 508 ppb
6/ EPA Water Quality Criteria (1976, 1980) = 59 ppb
7/ EPA Water Quality Criteria (1976, 1980) = 1,260 ppb
8/ EPA Water Quality Criteria (1976, 1980) = 23 ppb
9/ EPA Water Quality Criteria (1976, 1980) = 140 ppb
10/ EPA Water Quality Criteria (1976, 1980) = 10 ppb, LI means reading was less than instrument detection limit = 0.07 ppb
11/ EPA Water Quality Criteria (1976, 1980) = 0.13 ppb, LI means reading was less than instrument detection limit = 0.2 ppb

activities may have on the waters of the cove and the disposal site a comparison between the elutriate and the on site waters is important. Table 4 also indicates the level of chemical constituents in the waters at the dump site. Comparing the elutriate test results, conducted with dumpsite waters and dredged material, with the analysis of dumpsite waters without the dredged material indicates little significant difference between them.

Sessile benthic organisms inhabiting the channel and anchorage areas to be dredged would be destroyed by the dredging. Unaffected organisms inhabiting the substrate outside of the dredged area, however, should recolonize the disturbed areas rapidly. The types of organisms that generally inhabit very silty substrate, such as in North Cove, are adapted for recolonizing in short periods because they adjust to the many rigors and changes of salinity, turbidity, and contamination of an estuarine environment. An adaptive characteristic is that they may have several life cycles in a season to produce enough organisms to sustain the population from predation and other stresses (Rhodes et al., 1978). Since dredging activity would occur in the early spring and would take only a month's time, there will be good opportunity for recolonization during the growing season. These species are primarily the polychaete worms as well as perhaps small snails and bivalues. Bottom substrate in the harbror is not suitable habitat for productive shellfish beds of clams, mussels or oysters. As such, there will be no impact on any population of them. Some of the more opportunistic or pioneering species would be Nephyus sp., Capitella sp., Streblospio sp., Ampelisca sp., as well as possibly Mulinia sp. and Nassarius sp.

The DMF indicated that there was no lobster activity in the cove, but that blue crabs were quite active though their numbers in the anchorage is uncertain. Motile organisms such as the crabs and finfish, should be able to avoid the small areas of daily dredging activity earmarked by localized turbidity. Finfish should not be physically affected, with the exception of those individuals that become directly entrapped. Localized releases of high BOD bottom sediments may deplete the oxygen available for fish in the sediment plume, but should not present a substantive impact to any finfish resource otherwise in the cove or the Connecticut River. Dredging would not interfere with the presence or commercial harvesting of white perch, which are taken around their greatest occurence during late summer and late fall. DMF has indicated that, to the contrary, dredging appears to have benefitted the resource with deeper waters and perhaps a better substrate for benthic food organisms. Black flounder appear in the cove, but it is neither a significant habitat nor a spawning ground for them. DMF believes that dredging would not affect their existence or presence.

Dredging is proposed to be conducted with a mechanical bucket type dredge. Its action will disturb bottom sediments stirring up the substrate locally around the bucket and causing a low level of turbidity and sedimentation. Bucket dredging, however, localizes the effects and generally causes no significant problems. The more pronounced effect

would occur during dredging the channel inlet on an outgoing tide. The majority of the sediment would settle out within several hours, but some of the very fine particles could stay in suspension for many days (Corps of Engineers, 1977; Christodoulou, et al., 1974). Generally, sediments that reach the Connecticut River could travel about 150 yards and as far as 300 to 800 yards. This would be a maximum distance a fine sediment particle could travel assuming the particle remains in suspension. However, disturbed sediments generally would settle-out much more quickly in natural conditions due to particle collisions, flocculation and biological reworking (Humby and Dunn, 1975; Drake, 1976; Krone, 1972). In short distance, dredged-caused turbidity would be undetectable and well within ambient levels. Further reference citations and discussions are to be found in the Environmental Assessments of dredging activites for Rockport Harbor, Massachusetts (COE, November, 1983), for Boston Harbor, Massachusetts (COE, December, 1981) and for the EIS on Boston Harbor's Third Tunnel (FHA, 1983). Within the cove, turbidity would remain localized about the dredge because of the cove's low energy environment. The impacts would be very limited, restricted primrily to the cove. The short one month duration of dredging activity should not severely stress the continuation of any aquatic population in the cove.

The release of contaminants from the sediment during dredging or disposal operations will not cause a significant water quality impact. Information presented and cited in the aboved referenced documents indicates that there is no substantial release of metals from dredged materials during suspension and redeposition of the materials. See Table 4 for the elutriate test results which indicate the low level of contaminant release when the sediments are mixed with marine waters. Certain trace metals may be released in the parts per billion (ppb) range, while others show no release pattern. Mobility of heavy metals is restricted as they are not readily soluble and would be adsorbed to sediments or coprecipitated out of solution. The bulk sediment chemical results (Table 2) and the elutriate results (Table 4) for North Cove indicate that PCB and DDT levels in the sediments, or in the water after being mixed with the sediments, are all less than the levels of detection.

The bulk sediment chemical analysis indicated there was no unusual or substantial presence of elements that might cause significant environmental harm. Beside the elutriate tests mentioned above, bioaccumulation and bioassay tests were conducted to indicate the potential for biological impacts that could occur from dredging and disposal activities. The results of the tests are presented in Tables 5a, 5b and 6. As with the results of the bulk sediment analysis, the elutriate and bioassay analyses showed that dredging and disposal of the North Cove materials should not cause significant environmental harm. According to environment and dredged material disposal activity regulations, the materials would be acceptable for disposal at the Cornfield Shoals Disposal Site.

TABLE 5a
North Cove Bioassay

Results of Solid Phase bioassay with grass shrimp (Palaemonetes pugio), hard clams (Mercenaria mercenaria), and sandworms (Nereis virens) exposed for ten days to control sediment, reference (disposal-site) sediment, and solid phase of dredged material

Number of Survivors[a]

Intertidal Beach Sand, Hampton, NH.

Adjacent to Disposal Site

| TREATMENT | CONTROL | | | | DREDGE | | | | REFERENCE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Replicate | Grass Shrimp | Hard Clams | Sand Worms | Total | Grass Shrimp | Hard Clams | Sand Worms | Total | Grass Shrimp | Hard Clams | Sand Worms | Total |
| 1 | 40 | 19 | 20 | 79 | 36 | 20 | 18 | 74 | 37 | 20 | 19 | 76 |
| 2 | 37 | 20 | 20 | 77 | 40 | 20 | 19 | 79 | 40 | 20 | 19 | 79 |
| 3 | 39 | 20 | 20 | 79 | 40 | 20 | 19 | 79 | 40 | 20 | 20 | 80 |
| 4 | -- | -- | -- | -- | 37 | 20 | 19 | 76 | 40 | 20 | 20 | 80 |
| 5 | -- | -- | -- | -- | 32 | 20 | 13 | 65 | 39 | 20 | 14 | 73 |
| Mean ($\bar{x}$) | 38.6 | 19.7 | 20 | 78.3 | 37 | 20 | 17.6 | 74.6 | 39.2 | 20 | 18.4 | 77.6 |
| ---- (%) | 96.5 | 98.5 | 100 | 97.8 | 92.5 | 100 | 88 | 93.25 | 98 | 100 | 92 | 97 |

[a] Forty (40) grass shrimp, twenty (20) hard clams, and 20 sandworms were initially exposed to each replicate of a treatment. Thus, a total of 80 animals was employed in each aquarium.

TABLE 5b

North Cove Bioassay
Analysis of total (combined) survival date for grass shrimp (Palaemonetes pugio), hard clams, (Mercenaria mercenaria), and sandworms (Nereis virens) exposed for 10 days to control sediment, reference (disposal-site) sediment, and solid phase of dredged material.

Step 1. Total Survival Data (From Table 1)

| | Total Number of Survivors | | |
|---|---|---|---|
| Treatment (t) | Control Sediment | Reference Sediment | Dredge Sediment |
| Replicate (r) | | | |
| 1 | 79 | 76 | 74 |
| 2 | 77 | 79 | 79 |
| 3 | 79 | 80 | 79 |
| 4 | -- | 80 | 76 |
| 5 | -- | 73 | 65 |
| Mean ($\bar{x}$) | 78.3 (97.8%) | 77.6 (97%) | 74.6 (93.25%) |

TABLE 6
BIOACCUMULATION TEST RESULTS FOR NORTH COVE,
OLD SAYBROOK, CT

| Mean Concentration of Constituent | Grass Shrimp | Hard Clams | Sandworms |
|---|---|---|---|
| MERCURY (PPB) | | | |
| Reference Site | 0.0518 | 0.0184 | 0.012 |
| Dredged Material | 0.042 | 0.0134 | 0.0092 |
| Result | Further Analysis Not Warranted | Further Analysis Not Warranted | Further Analysis Not Warranted |
| CADMIUM (PPB) | | | |
| Reference Site | 0.268 | 0.1728 | 0.152 |
| Dredged Material | 0.391 | 0.174 | 0.112 |
| Result | No statistical significance | No statistical significance | Further Analysis Not Warranted |
| DDT (PPB) | | | |
| Reference Site | 0.04 | 0.04 | 0.04 |
| Dredged Material | 0.04 | 0.04 | 0.04 |
| Result | Further Analysis Not Warranted | Further Analysis Not Warranted | Further Analysis Not Warranted |
| PCB (PPB) | | | |
| Reference Site | 0.04 | 0.04 | 0.048 |
| Dredged Material | 0.04 | 0.046 | 0.052 |
| Result | Further Analysis Not Warranted | No Statistical Significance | Further Analysis Not Warranted |
| Aromatic Petroleum Hydrocarbons (PPB) | | | |
| Reference Site | 11.6 | 0.66 | 1.6 |
| Dredged Material | 8.9 | 1.48 | 2.76 |
| Result | Further Analysis Not Warranted | No statistical significance | No statistical significance |

The most severe impact of the disposal activity would be deposition of material on top of organisms at the disposal site. Characteristics of the site generally reflect those of a dispersal site (1976 Assessment). Tidal currents through the area average 22.73 centimeters/second and the residual currents average 26.21 centimeters per second (DAMOS, 1979). Other than for small remnants, there is no significant presence of previous dredged materials remaining at the site. Apparently, deposited materials are eventually winnowed from the site, leaving a characteristically sandy to sandy silt bottom. Detailed benthic studies at the site have not been conducted, however, a limited DAMOS site assessment showed the site was sparsely populated with only a few species (Anthozoan sp, Anachis lafresnoyi, Lunatia heros, Nassarius trivittatus, Urosalpinx cinerea). A previous study by Pratt (1977) also found beds of blue mussels on the stable bottoms of the dump site and central depressions, and that other invertebrates took advantage of the food and shelter which these beds offered. The DAMOS study did not report any occurance of these organisms, indicating the potential for only spot or patchy development for bottom dwelling benthic organisms. Therefore, accurate information is not available to make an account of the type and numbers of organisms that would be lost during disposal. This area, however, when compared to other sites, such as the closely located reference site described in the DAMOS report, appears not to support a fishery habitat. During the DAMOS investigation there were no observations of lobster bouys or commercial or sport fishing activity.

Disposal activity will likely smother most organisms in the immediate discharge area (beneath releases of the materials). The impact would eliminate these organisms as a food source for bottom feeding fish. Since the site has experienced alterations previously from disposal operations, this project would not introduce a new impact for which new or unusual biological acclimation would be necessary.

## VI. Alternatives

The project is a dredging activity to maintain an existing use for boating activities. There are no alternatives to providing adequate depth for an existing fleet of boats other than to decide not to maintain the project. There are alternative methods for conducting the work and disposing of the dredged material.

Disposal site alternatives have been investigated previously for the 1976 Assessment. No reasonable sites (size, location, distance) were found for upland disposal, or sites to create added wetlands with the dredged material. Presently, the cove's shore area is bordered by wetlands. The areas inland of the cove are predominantly residential with little area providing opportunity to accept dredged materials. A new potential use, not previously available for consideration in the 1976 Assessment, was the Town's proposal to obtain approximately 2,000 cubic yards of the cove's sandy dredged material for placement at a local park. The high cost of using this material, however, became prohibitive

for the Town. But, to assess the environmental acceptability of transporting and using the harbor sediments for an upland fill use, an EP Toxicity test was conducted prior to the town's decision not to use the material. The results are presented in Table 7 and they indicate that the material would be environmentally acceptable for fill purposes.

Since the disposal options are limited, alternative methods for dredging are reasonably restricted to mechanical means, which beneficially reduces the need to experience the impacts associated with other types of dredging.

Open water disposal at Central Long Island Sound (CLIS) Disposal Site, or the New London Disposal Site (NLDS), is an alternative to the use of the Cornfield Shoals site. These sites are principally known as containment sites rather than dispersal sites such as Cornfield Shoals. An additional haul distance of 50 nautical miles per round trip would be required if the CLIS site were used instead of Cornfield Shoals; an additional haul of 30 nautical miles per round trip for the NLDS would be necessary should NLDS be used instead of Cornfield Shoals. There does not appear to be any significant environmental advantages for utilizing either the CLIS Disposal Site or the NLDS to justify incurring additional project costs.

## VII. Coordination and Public Involvement

The proposed work has been coordinated directly with the U.S. Environmental Protection Agency, U.S. Fish & Wildlife Service, the National Marine Fisheries Service, Connecticut Department of Environmental Protection, Connecticut Department of Agriculture - Aquaculture Division, Connecticut State Historic Preservation Office, Connecticut Coastal Area Management Program, and the Town of Old Saybrook. A public notice describing the proposed work was also issued on October 28, 1983. Several hundred copies of the notice were distributed to the Federal, State and local agencies, special interest groups, private organizations and individuals. No adverse comments have been received regarding the proposed work.

Table 7

EP TOXICITY TEST RESULTS
NORTH COVE, OLD SAYBROOK, CT

| TEST PARAMETER | A | B | C | D |
|---|---|---|---|---|
| ENDRIN | LI | LI | LI | LI |
| LINDANE | LI | LI | LI | LI |
| METHOXYCHLOR | LI | LI | LI | LI |
| TOXAPHENE | LI | LI | LI | LI |
| 2,4 D | LI | LI | LI | LI |
| SILVEX | LI | LI | LI | LI |
| CADMIUM | LI | LI | LI | LI |
| CHROMIUM | LI | LI | LI | LI |
| LEAD | LI | LI | LI | LI |
| MERCURY | LI | LI | LI | LI |
| SELENIUM | LI | LI | LI | LI |
| SILVER | LI | LI | LI | LI |
| ARSENIC (PPM) | 0.049 | 0.034 | 0.033 | 0.015 |
| BARIUM (PPM) | 0.17 | 0.22 | 0.33 | 0.28 |

LI indicates that the concentration of the compound was less than the detection limits of the instrument as listed below:

DETECTION LIMITS

ENDRIN = 0.2 PPB
LINDANE = 0.05 PPB
METHOXYCHLOR = 1 PPB
2,4 D = 0.2 PPB
SILVEX = 0.2 PPB
CADMIUM = 0.005 PPM
CHROMIUM = 0.01 PPM
LEAD = 0.02 PPM
SELENIUM = 0.1 PPM
SILVER = 0.01 PPM

## VIII. References


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NORTH COVE, OLD SAYBROOK, CT
SECTION 404 (b)(1) EVALUATION
FOR MAINTENANCE DREDGING

References:

a. Section 404(b) of Public Law 92-500, as amended, Clean Water Act.

b. 40 CFR Part 230 Subparts A,B,C,D,E,F,G, and H, dated 24 December 1980.

I. Project Description

a. Location

The proposed project area is located off the mouth of the Connecticut River, part of the river's tidal estuary,in North Cove, Old Saybrook, Connecticut.

b. General Description

The proposed plan consists of removal of 75,000 cubic yards of shoaled materials by a mechanical dredge, and transporting the material by barge for disposal at the Cornfield Shoal Disposal Site in Long Island Sound. The materials have accumulated in the entrance channel and anchorage. The Cornfield Shoal site has been historically used for disposal of materials from the North Cove vicinity and other dredged areas, such as Clinton Harbor, the Connecticut River below Hartford, and for dredging by Northeast Utilities, Saybrook Point Marina, Clinton Harbor Marina and Old Lyme. Dredging and disposal operations would take place over approximately a 30-day period in spring 1984.

c. Authority and Purpose

The purpose of the proposed activity is to maintain safe and efficient depths in the Federal channel and anchorage for the cove's navigational use. The harbor facilities in the cove area deal almost exclusively in recreational pleasure yachting with a small commercial fishery compatably utilizing the deeper waters of the anchorage area.

Federal projects in the Connecticut River below Hartford were authorized in 1872. The authorized project has been amended several times; North Cove was authorized by the Chief of Engineers in 1960-61 under authority of Section 107 of the 1960 River and Harbor Act.

d. General Description of Dredged - Fill Material

The material consists of sandy silt, silty-fine sand, organic debris and shell fragments. The volume of material is approximately 75,000 cubic yards from shoaled areas in the Federal entrance channel and

the anchorage area and another 700 cubic yards of material from a proposed private action to maintain depths at the North Cove Marina. There is no unusual accumulation of heavy metals or other contaminants.

e. Description of the Proposed Discharge Site

The Cornfield Shoal disposal site is the proposed discharge area, and is located in Long Island Sound, between Cornfield Point, Lynde Neck, Connecticut, and Rocky Point, Long Island. Depths at the site average between 52-58 meters at Mean Low Water (MLW). Bottom sediments consist principally of silts, silty-sands and sands (0.2 - 0.01 mm; see Attachment 1, Environmental Assessment). The site is considered a dispersal site (DAMOS, 1979 -- See Section IX in Environmental Assessment). The discharges would occur over a 30-day period in the spring of 1984.

f. Description of the Disposal Method

The dredged material would be removed by a mechanical dredge and loaded into a scow. In this operation a bucket would be either dragged a short distance along the bottom to scoop up materials or the operation would employ a hinged bucket that would take a "bite" out of the bottom. The materials would be loaded into a bottom opening scow for transport to and release at the disposal site.

II. Factual Determination (Section 230.11)

a. Physical Substrate Determinations

The proposed discharge site would not undergo any significant long term change in the present characteristics of the substrate due to the proposed discharge. The physical characteristics of the dredged material and of the reference site adjacent to the disposal site are described in the Environmental Assessment, Sections IV and V, and in its Attachment No. 1. The dredged material is predominantly fine sand, sandy-silt and silt and is generally more fine than the related disposal site (and reference site) characteristics. No specific spoil mound has been found at the disposal site. Isolated patches of previously dredged materials are present in the area. The site is generally known to have moderate tidal current energy and the sediments are generally clean sands with some isolated gravel spots (DAMOS, 1979). Disposal of the finer dredged sediments will change the sediment make-up where it is deposited over the coarser materials at the site. This would keep within the present character of the site having isolated spots of dredged materials. The lack of a uniform disposal mound and the presence of moderate current energies are indications that the disposal site is a dispersal type site. Placing finer dredged materials over dissimilar coarse sediments at the site, however, would cause only a temporary impact because the fine materials would slowly and eventually disperse over a large area until they settle into a low energy environment with similar sediment characteristics (Environmental Assessment, Section V). This type

of shifting is probably not unusual for Long Island Sound (Rhodes, citing McCall; 1978).

The substrate elevation and slope at the disposal site would not be significantly changed by the discharge of the dredge material. The proposed disposal site is located in a deep trough in a high energy area. The dredge material would initially build up during disposal and then gradually erode.

Detailed chemical analysis done on the bottom materials at the disposal site was conducted during the DAMOS study. Sediments at the dredge site showed higher contaminant levels, generally less than an order of magnitude, but were characteristically similar to those found at the disposal site. The sediments to be dredged are made up of silty sands and sandy silts, organics and shell fragments.

Because of the cohesive nature of the material and mechanical means of dredged material removal, discharged sediments should settle quickly over the site. The current should spread the small amount of material so that a permanent mound would not form. Historic remnants of previous dredging disposals have not been evident in large amounts in localized mounds.

The disposal of dredged sediments will bury benthic organisms at the discharge site. Highly motile forms such as fish or crabs would be able to move out of the area. There would be no changes in sediment type that could have an adverse physical effect on benthic organisms. A study of the site showed that the site has low benthic diversity and productivity , and that wide patchiness probably exists. The few numbers of organisms appeared to indicate the low productivity of the populations at the site, but could also have been the result of the sampling regime in a patchy area.

The small amount of material (75,000 cubic yards) would gradually erode and should not significantly alter the natural processes in Long Island Sound. If the weather is windy, the descent of the sediments particles could be delayed by the higher surface current velocities. However, disposal would not take place if the waters are too rough.

The proposed project would not involve dredge or fill activities in any wetlands.

b. Water Circulation, Fluctuation, and Salinity Determinations

Current patterns, circulation, normal water fluctuation and the tidal regime would not be altered so as to result in any adverse impacts on the environment.

Chemical and physical characteristics including pH, dissolved oxygen levels, nutrients, clarity, color, and odor would not be

permanently changed from present conditions. There would be no significant introduction of nutrients that would result in the possibility of increased eutrophication.

Discharge of fill would not restrict or reduce the freshwater or estuarine flow into and through the Connecticut River, its estuary or Long Island Sound. Therefore, existing salinity patterns and mixing characteristics would not be altered in or around receiving waters.

c. Suspended Particulate/Turbidity Determination

Disposal activities are expected to temporarily increase suspended particulate and turbidity levels. This increase would be minimal, and no long term impacts are expected. The currents would spread out a small amount of material, but sediment particles should settle out quickly because of the material's sandy-silt composition and cohesive excavation method. The discharge of the dredged shoal material would not violate such water quality standards as are appropriate and applicable by law. This project would require that Water Quality Certification be obtained from the State prior to its implementation. As such, the project would not be conducted unless it meets with the State's water quality approval.

Chemical and physical properties of the water column would not be adversely affected. Light penetration may be temporarily reduced during disposal activities as the result of turbidity. Dissolved oxygen levels should not be reduced by the proposed discharge. There would be no significant introduction of toxic metals or pathogens, and organic loads would not increase (see Subsection d, following). The aesthetics of the Sound's water immediately around the scow would be temporarily and minimally impacted by the presence of released materials.

The processes of primary production and photosynthesis would be affected by increases in suspended particulates in the water column immediately after disposal, but this would cover only a small volume of water lasting only as long as it would take for the sediment to settle through the photic zone. Suspension and filter feeders would also not be adversely affected because of the short period of time for the project to be completed.

d. Contaminant Determination

The material proposed for discharge would not introduce, relocate, or increase contaminants at the proposed disposal site. The shoal material consists of predominantly unpolluted silty sediments and organics, and does not contain any unusual presence or high levels of trace metals or other contaminent elements. The materials would be characterized as being of Class I contaminant quality under the Connecticut-New York classification system. There would not be any significant release of metals or other contaminants above the detectable

limits. See subsection f and the Environmental Assessment, Tables 2 and 4.

e. Aquatic ecosystem and organism determination

Discharge of the dredged material would not significantly disrupt the chemical, physical, or biological long-term integrity of the aquatic ecosystem. The food chain would not be significantly disrupted in such a manner as to alter or decrease diversity of plant or animal species.

Discharge activities may temporarily disrupt faunal movement but are not expected to significantly interfere with movement of any species into or out of their feeding, spawning, breeding, or nursery areas. Turbidity would be temporary. Disposal activities have been scheduled for early spring and would not impact on spawning or anadromous fish activities.

Discharge of the dredged material would not release pollutants that could be moved by currents or wave action into any productive shellfish beds. There would not be undesirable changes in current patterns, salinity patterns and flushing rates which would affect shellfish. Disposal activities would not interfere with reproductive processes or cause undue stress to juvenile shellfish forms. The distance of the site from productive coastal beds, the nature of the material and the deep contours of the disposal site should keep the material from becoming resuspended to the point of affecting shellfish in the shallower areas. The discharge site is not known as an area fished by local lobstermen.

Discharge activities would destroy benthic organisms inhabiting the immediate areas. Highly motile organisms would be able to move out of the area. Sessile organisms would be buried. The site, however, is characterized by low productivity, low diversity and highly probable patchy benthic colonization (see the Environmental Consequences section of the Environmental Assessment). The site would recolonize quickly with the opportunistic species which are already the predominant inhabitants of the site.

Discharge of the material would not degrade substrate, water quality and hydrological parameters as determined through application of Sections 230.11(a) and (b).

Additional analysis of the biological community at the disposal site is considered unnecessary. Placement of the dredged shoal material would not result in additional substantive long-term degradation of the benthic habitat, water quality or a release of undesirable contaminants in the surrounding environment.

No Federally listed or proposed endangered or threatened species under Section 7 of the Endangered Species Act are known to exist in the disposal area except for occasional transient individuals.

There are no special aquatic sites in the disposal area or that would be affected by disposal.

f. Proposed Disposal Site Determinations

The potential for release of contaminants from the dredged materials into the water at the disposal site was evaluated through the use of an elutriate test. It was used to compare the disposal site waters to the same disposal site waters after having been mixed with the dredged materials. The results of this test, shown in Table 4 of the Environmental Assessment, indicated that the chemical contaminant levels of the disposal site waters before and after the introduction of dredged materials, were not substantively different (less than one order of magnitude). As Table 4 indicates, several contaminants were released into the water, but all releases remained below the water criteria standards. No substantial levels of chemical release would occur as a result of disposal. Application of a mixing zone with such determinants as currents, rates of discharge, water depth, etc., and as it might be applied to the Ocean Dumping regulations is not additionally necessary.

g. Determination of cumulative effects on the aquatic ecosystem

North Cove will need to be dredged periodically, and a disposal site chosen for the material. Should the proposed Cornfield Shoals site be used again, there should be no additive cumulative effects on the aquatic ecosystem. Shortly after disposal is completed, the current should slowly disperse the material, and the site characteristics would be similar to predisposal conditions. The cumulative toxic effects on the site's benthic biota were evaluated with bioassay/bioaccumulation tests. They did not indicate potential for significant aquatic degradation, so that the materials would be acceptable for open water disposal according to Ocean Dumping regulations.

h. Determination of secondary effects on the aquatic ecosystem

There would be little or no adverse secondary effects on the aquatic ecosystem as the result of the proposed discharge. There should be minimal interference with spawning, breeding, feeding, or nursery areas of aquatic fauna because of the small area in the aquatic ecosystem that could be affected by discharge activities, and the timing of the work in the early spring. There would be no significant bioaccumulation of contaminants or severe releases of contaminants into the water column, as the elutriate test have indicated (see the Environmental Assessment). There would also be little significant secondary effects on any food sources for predators in the area. The area presently is characterized by low benthic diversity and productivity indicating that it has low potential to support all but a minimal standing crop of food source organisms.

FINDING OF COMPLIANCE
FOR
NORTH COVE, OLD SAYBROOK, CT
MAINTENANCE DREDGING

1. No significant adaptations of the guidelines were made relative to this evaluation.

2. A detailed discussion of the rationale for selection of the proposed plan can be found in the Environmental Assessment. Use of an upland disposal site would have resulted in significantly increased costs and was judged not to be a practical alternative. All disposal sites have been considered for their feasibility.

3. The proposed discharge would not violate any applicable State water quality standards. The Toxic Effluent Standards of Section 307 of the Clean Water Act would not be violated.

4. The proposed discharge would not harm any species listed as endangered under the Endangered Species Act of 1973. Use of the selected disposal site would not impact critical habitat or violate protective measures as designated under the Marine Protection Research and Sanctuaries Act of 1972.

5. The proposed discharge would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values would not occur.

6. Appropriate steps to minimize potential adverse impacts of the discharge on the aquatic system include cessation of disposal activities during extreme weather conditions and early seasonal timing. Disposal activities are under the inspection and supervision of Corps of Engineer's personnel.

7. On the basis of the guidelines, the proposed disposal site for the discharge of dredged material is specified as complying with the guidelines having the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

Statement

The proposed site for the placement of dredge material at the open water site in Long Island Sound, Cornfield Shoals Disposal Site, has been specified through the application of Section 404(b) Guidelines. As well, the Ocean Dumping Criteria of Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 have been satisfied.

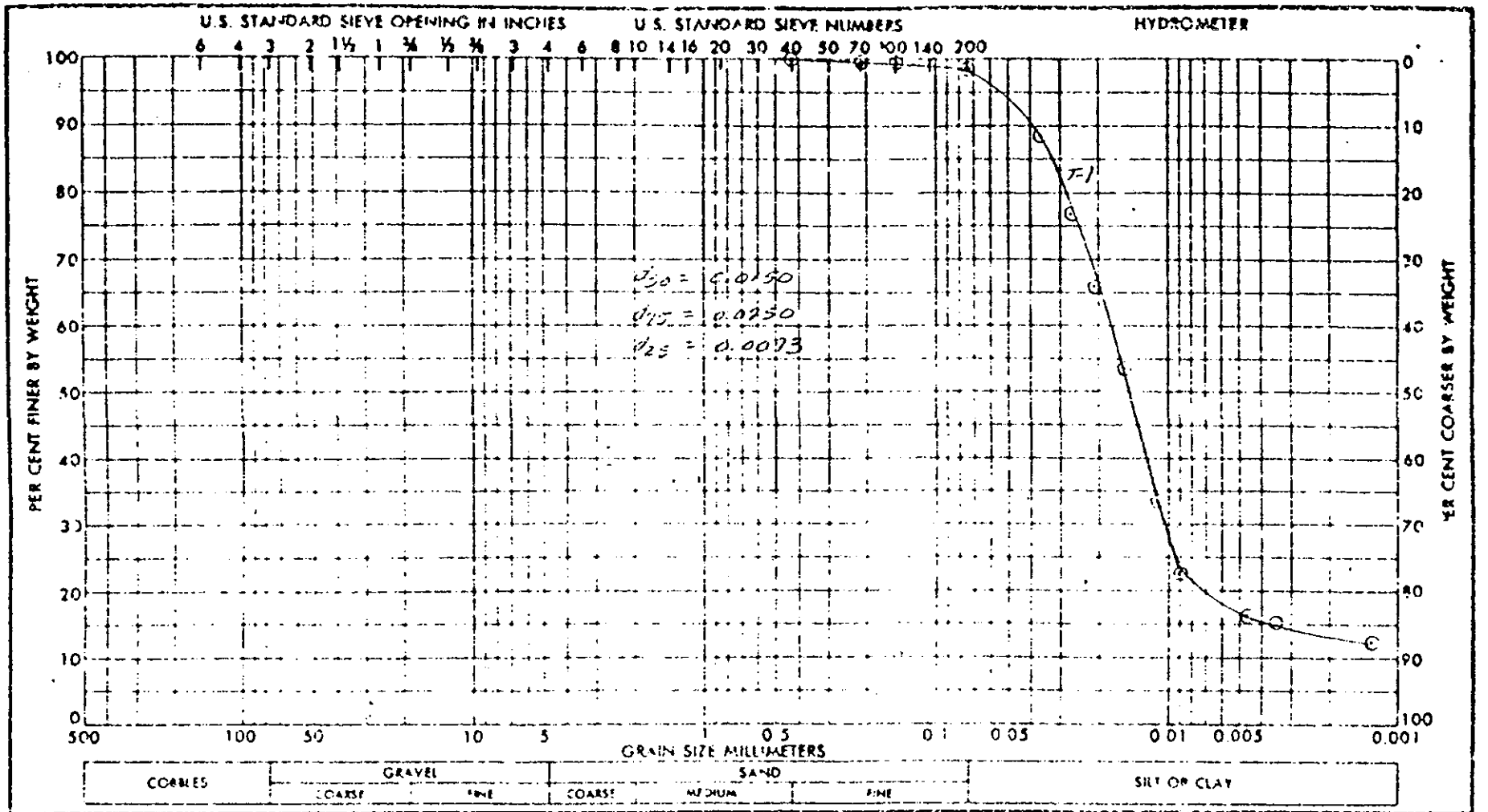
The project files and Federal regulations were reviewed to properly evaluate the objectives of Section 404(b) of Public Law 92-500, as amended. Based on information presented in this Section 404 Evaluation, I find the project would not result in unacceptable impacts to the environment.

16 MAR 84
DATE

CARL B. SCIPLE
Colonel, Corps of Engineers
Division Engineer

ATTACHMENT 1

1975 Sediment Gradation Curves
1983 Sediment Gradation Curves




| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| T-1 | 0.0'-1.95' | Organic SILT (OH) | * | 84 | 46 | 38 |
| | | | ** | 62 | 45 | 17 |

* Test run on natural soil

** Test run on oven dried soil

GRADATION CURVES

PROJECT North Cove

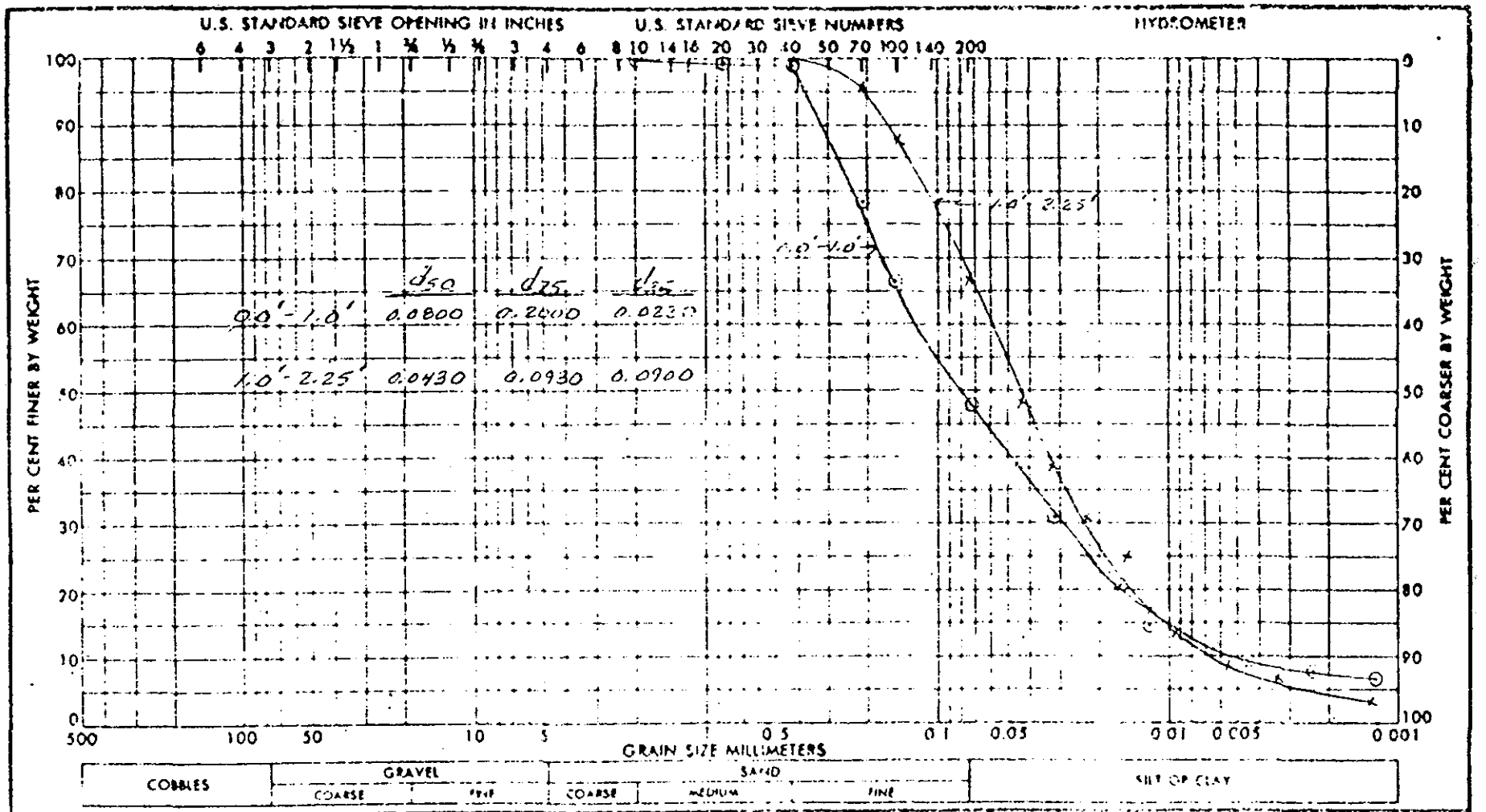
Old Saybrook, Conn.

AREA

BORING NO. T-1

DATE January 1975

FORM 2087 REPLACES WES FORM NO 1241, SEP 1967, WHICH IS OBSOLETE

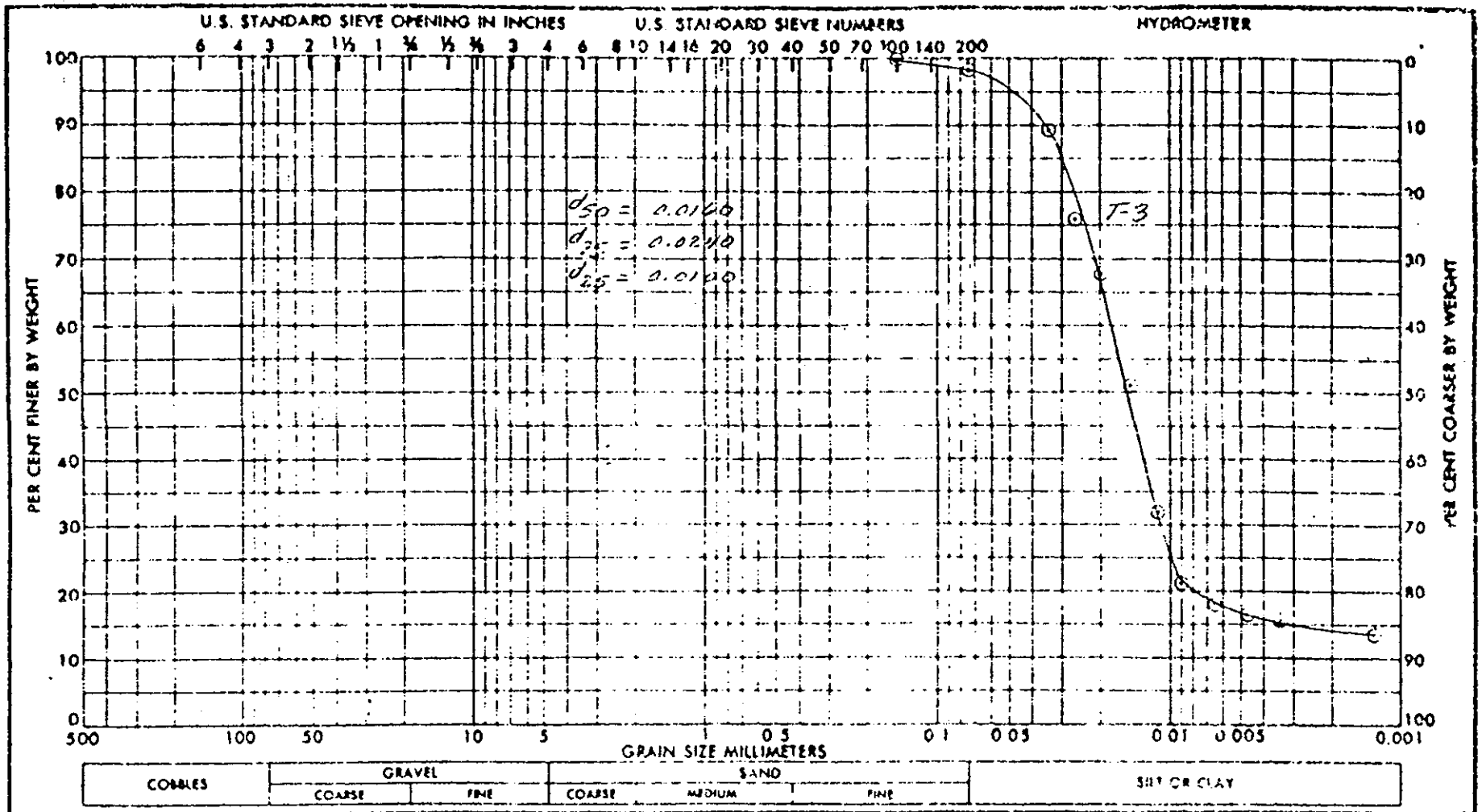



| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT. W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| T-3 | 0.0'-1.0' | Organic silt with sand (OH) | | 39 | 28 | 11 |
| T-3 | 1.0'-2.25' | fine sandy organic silt (OL) | | 42 | 31 | 11 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

GRADATION CURVES

PROJECT North Cove
Old Saybrook, Conn.
AREA
BORING NO. PE-2
DATE January 1975

ENG FORM 2087 REPLACES WES FORM NO. 1241, SEP 1962 WHICH IS OBSOLETE



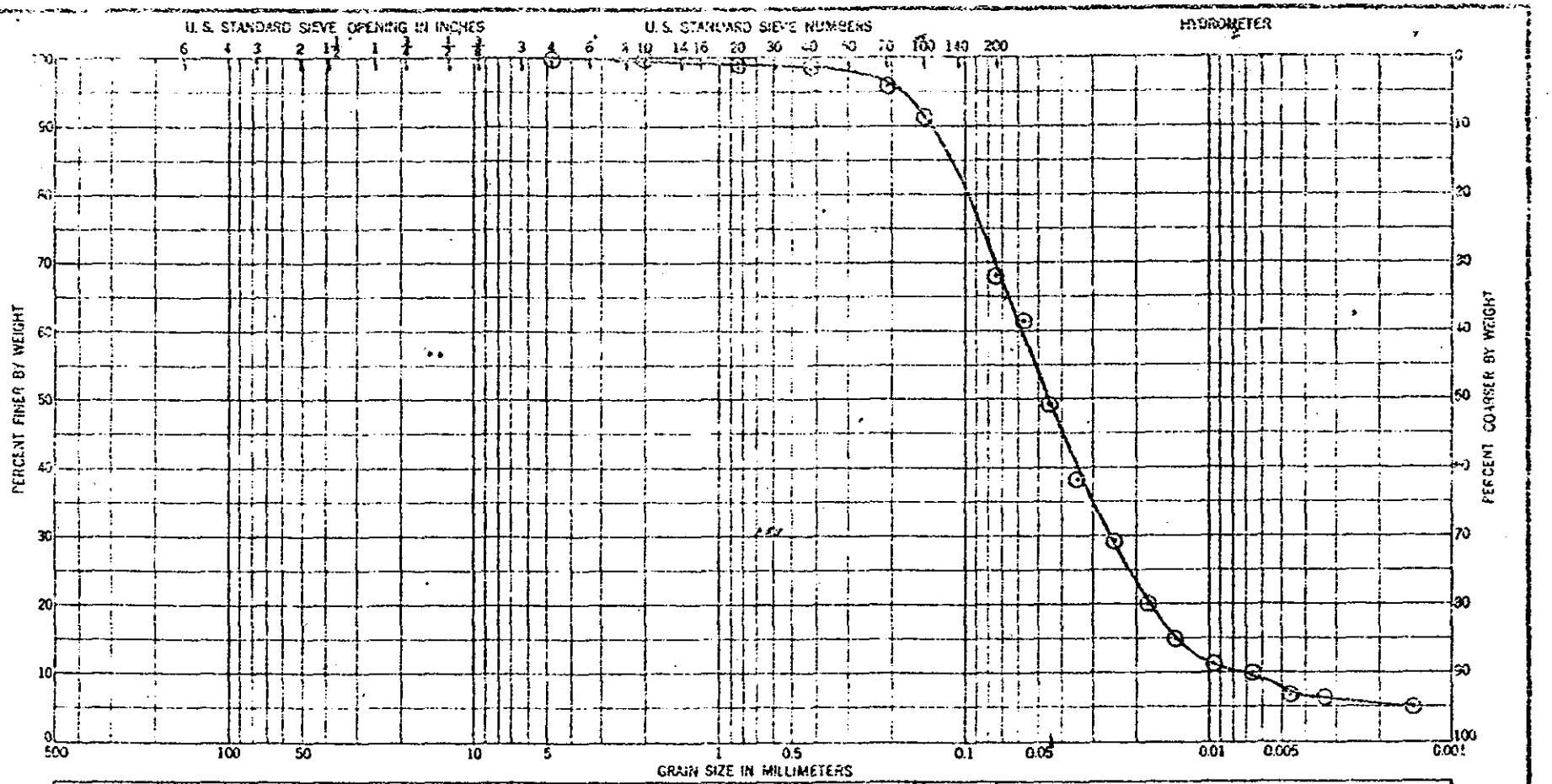

| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| T-3 | 0.0'- 2.2' | Organic Silt (OH) | | 83 | 45 | 38 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

GRADATION CURVES

PROJECT North Cove
OIJ Eastbrook, Conn.
AREA
BORING NO PE-3
DATE January 1975

ENG FORM 2087 REPLACES WES FORM NO 1241, SEP 1962, WHICH IS OBSOLETE

1983 Sediment Gradation Curves

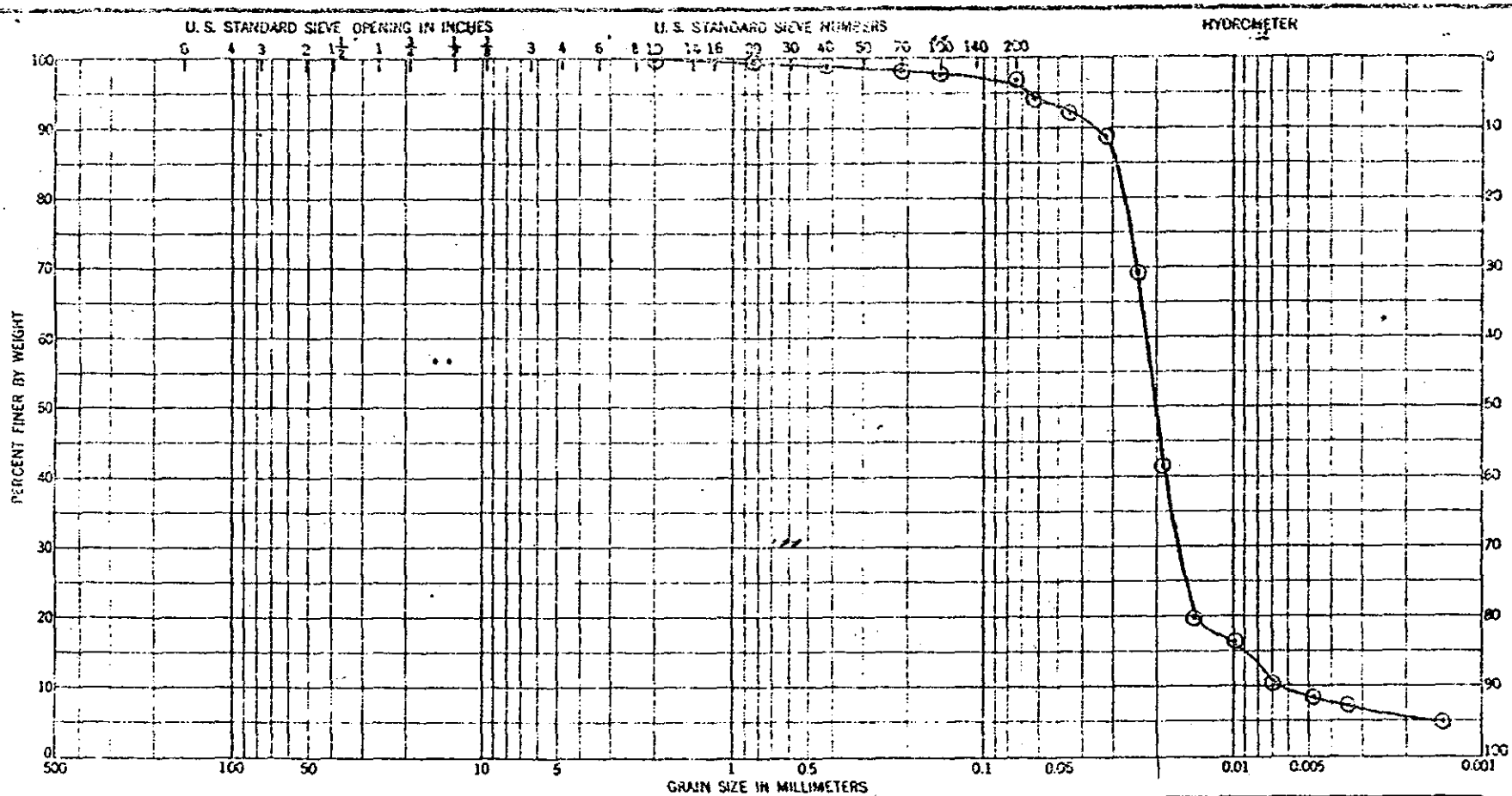



| Sample No. | Elev or Depth | Classification | Nat w % | L.L. | P.L. | P.I. |
|---|---|---|---|---|---|---|
| A | | Dk gray - sandy SILT (ML-MH) w/ mar odor | | 50 | 31 | 19 |
| | | Sp. Gr = 2.70 | | | | |

GRADATION CURVES

Project: NORTH COVE
OLD SAYBROOK, CT
Area: A
LAS SER
Boring No.: 100-369-1
Date: 11/17/83

ENG FORM 2087

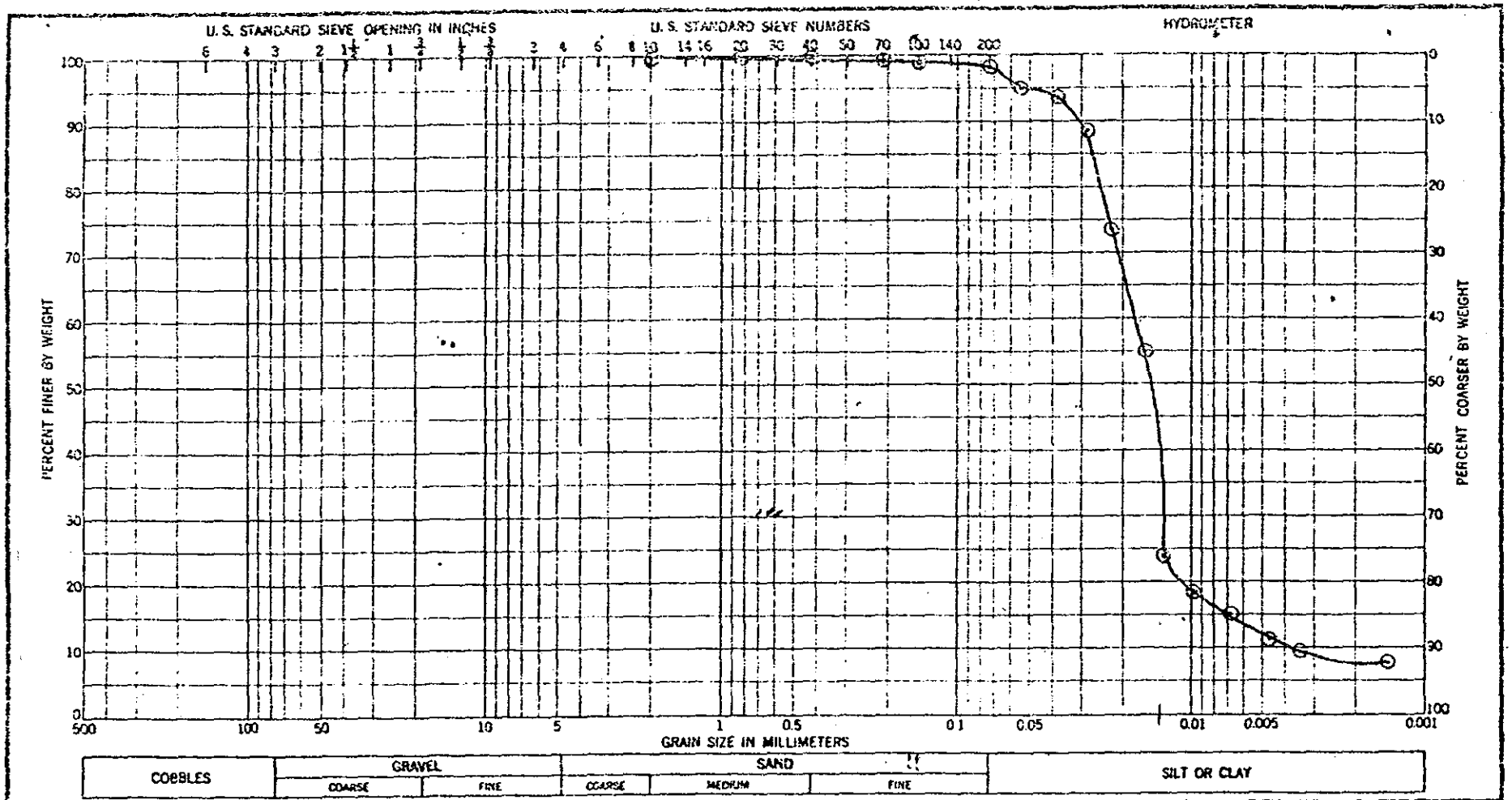



| Sample No. | ± Elev or Depth | Classification | Nat w % | LL | PL | PI |
|---|---|---|---|---|---|---|
| B | | Dk. gray - SILT (MH) w/ mar odor | | 100 | 53 | 47 |
| | | Sp. Gr. = 2.60 | | | | |

GRADATION CURVES

Project: NORTH COVE, OLD SAYBROOK, CT
Area: B
LAB SER: 100-369-2
Boring No.:
Date: 6/12/93

ENG FORM 2087 1 MAY 83

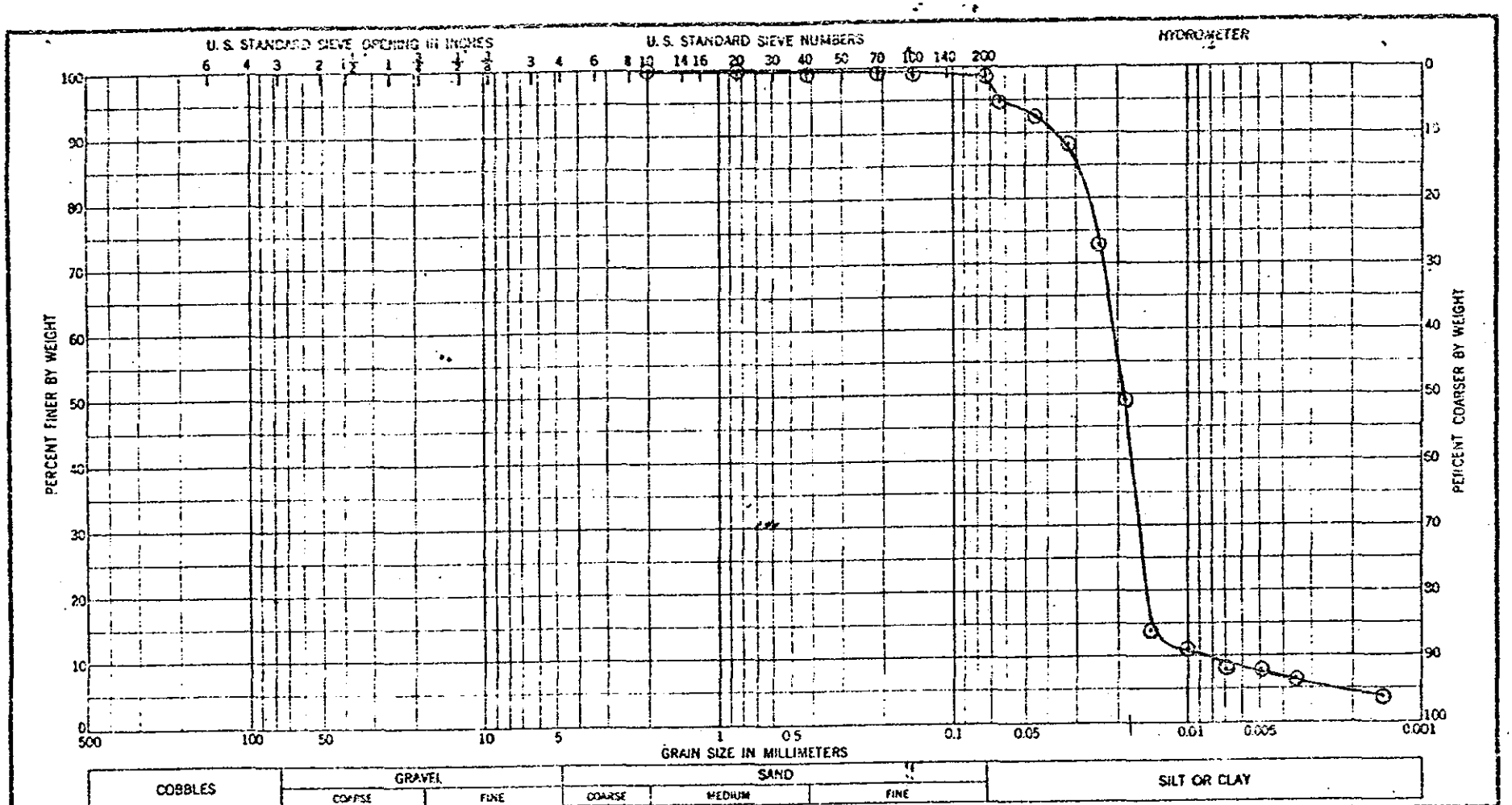



| Sample No. | Elev or Depth | Classification | Nat w % | LL | PL | PI |
|---|---|---|---|---|---|---|
| C | | Dk. gray-org. SILT (OH) w/m.ar. odor | | 102 | 50 | 52 |
| | | So. Gr. = 2.58 | | | | |

GRADATION CURVES

Project: NORTH COVE - OLD SAYBROOK, CT
Area: C
LAB SER
Boring No.: 100-369-3
Date: 11/17/93

ENG FORM MAY 61 2087

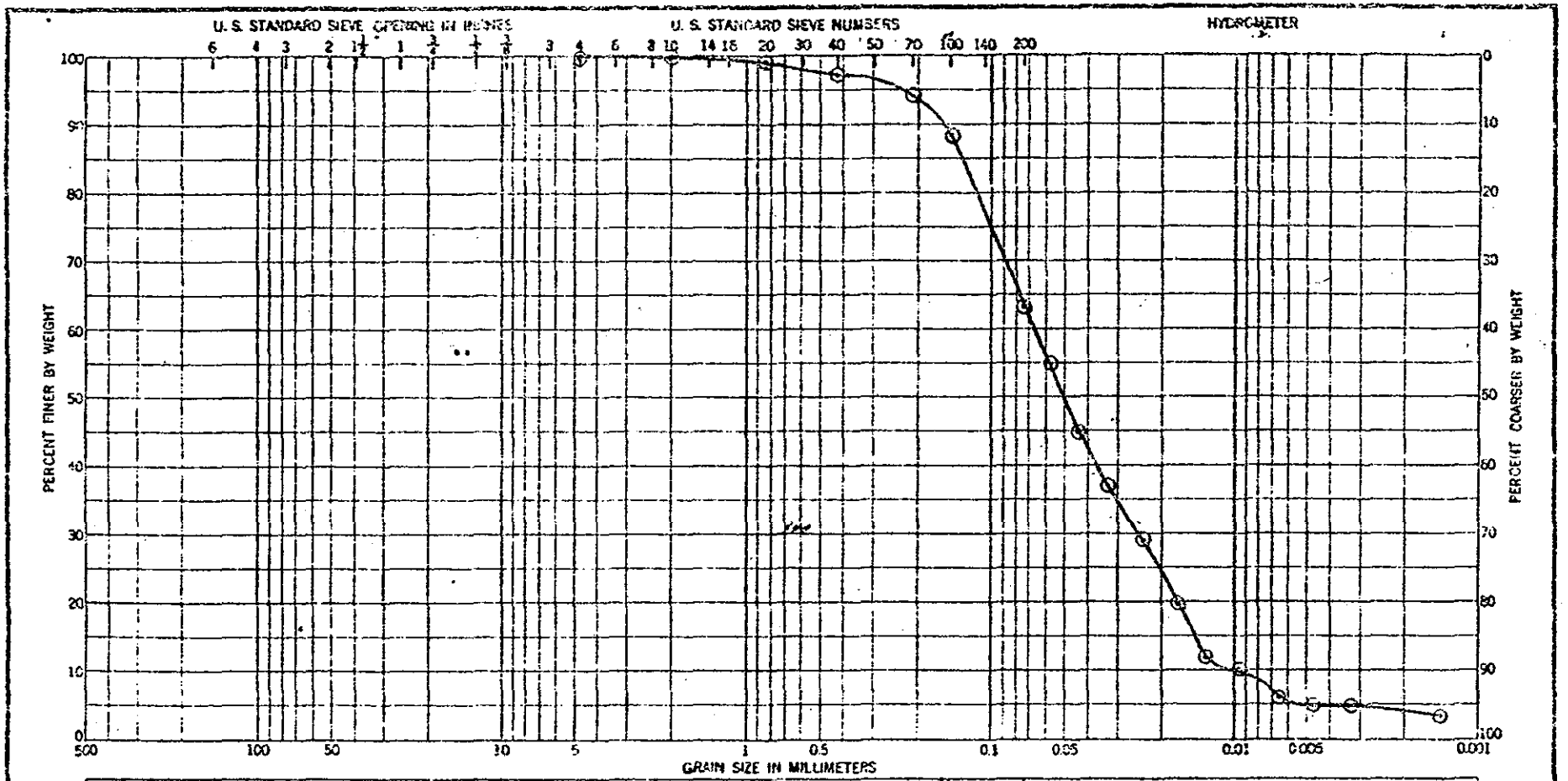



| Sample No. | Elev or Depth | Classification | Nat w % | LL | PL | PI |
|---|---|---|---|---|---|---|
| D | | Dk. gray - org. SILT (OH) w/ mar odor | | 106 | 55 | 51 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | Sp. Gr. = 2.57 | | | | |

GRADATION CURVES

Project: NORTH COVE
OLD SAYBROOK, CT
Area: D
Boring No.: DB SER 100-369-4
Date: 11/17/83

ENG FORM MAY 68 2087

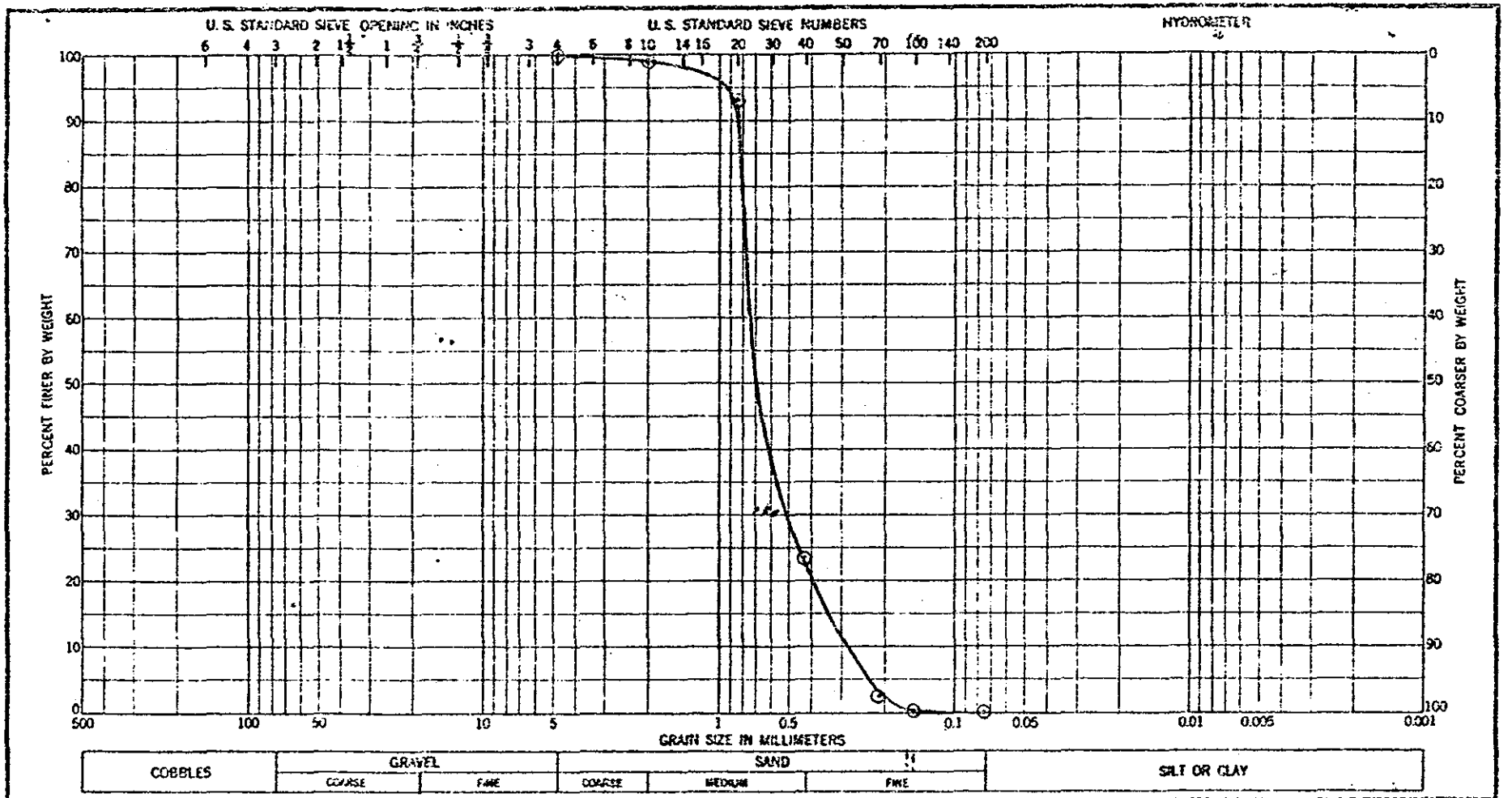



| Sample No | Elev or Depth | Classification | Nat w % | LL | PL | PI |
|---|---|---|---|---|---|---|
| COMPOSITE | | Dk. gray-sandy SILT(ML) Sulfury + odor | | 45 | 29 | 16 |
| | | Sp. Gr. = 2.68 | | | | |

GRADATION CURVES

Project: NORTH COVE
OLD SAYBROOK, CT
Area: COMPOSITE
LAB SER
Boring No. 100-369-7
Date 11/17/83

ENG FORM 1 MAY 83 2087




| Sample No. | Elev or Depth | Classification | Nat w % | LL | PL | PI |
|---|---|---|---|---|---|---|
| REFERENCE | | Dk. brown - m-f SAND (SP) w/ shell frag | | | | |
| | | Sp. Gr. = 2.69 | | | | |

GRADATION CURVES

Project: NORTH COVE
OLD SAYBROOK, CT
Area: REFERENCE
LAB SER
Boring No.: 100-369-8
Date: 11/17/83

ATTACHMENT 2

STATEMENT OF FINDINGS

PROPOSED MAINTENANCE DREDGING OF

NORTH COVE, OLD SAYBROOK, CONNECTICUT AND

BROCKWAY BAR AND ESSEX SHOAL, CONNECTICUT RIVER

STATE OF CONNECTICUT

Upon evaluating the environmental assessment, it is my belief and conclusion that the continued maintenance dredging of North Cove, Brockway Bar and Essex Shoal is in the best public interest and does not constitute a major Federal action requiring an environmental impact statement.

The maintenance dredging will restore the waterways to their authorized conditions and allow a continuance of economic benefits to recreation and commercial boating activity. Maintenance of Brockway Bar and Essex Shoal is part of the overall maintenance activity for the channel leading to Hartford which is the only commercial navigation artery to that city. Over 3.5 million tons of commerce, mainly petroleum products, are carried on the waterway annually.

Dredging operations will have minor and short lived environmental impacts. These impacts will be limited to the immediate vicinity of dredging operations and will dissipate once dredging activity is suspended.

Minor impacts will occur at the proposed disposal site. The disposal site is located in approximately 170' of water in an area considered to favor containment of dredge material. Due to its depth the area in all likelihood is too deep for commercial or sport fishery. Disposal at the Cornfield Shoal Dumping Ground is in consonance with the management proposal of the Connecticut Department of Environmental Protection which allows 4 regional dredge disposal sites for Long Island Sound including the proposed dumping grounds. Long-term impacts related with the proposed actions contained in the project's assessment and with future use of the dumping sites are not well known. These impacts are related with the long-term use of the site, volume and types of materials disposed, and a study of the energy system of the site to determine potential movement of disposed material. These impacts will be the subject of studies leading to the eventual development of a regional

environmental impact statement addressing disposal activities in Long Island Sound.

## CONCLUSIONS

Based on my review of the information within the project's assessment and in consideration of the general public need, I believe the project as described should proceed according to schedule. In my evaluation the assessment prepared in accordance with the National Environmental Policy Act of 1969 is an accurate document revealing that the negative environmental impacts associated with the project are minor. The assessment, therefore, precludes the need for preparation of an environmental impact statement.

4 May 1976
DATE

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

# ENVIRONMENTAL ASSESSMENT

## PROPOSED MAINTENANCE DREDGING OF
## NORTH COVE, OLD SAYBROOK, CONNECTICUT AND
## BROCKWAY BAR AND ESSEX SHOAL, CONNECTICUT RIVER
## STATE OF CONNECTICUT

Prepared by

New England Division
U.S. Army Corps of Engineers
Waltham, Massachusetts

May 1976

SUMMARY SHEET

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action:

The subject action is to conduct maintenance dredging at North Cove, Old Saybrook, Connecticut, and at Brockway Bar and Essex Shoal in the mainstem of the Connecticut River. The project calls for dredging of 110,000 cubic yards from North Cove, 23,000 cubic yards from Brockway Bar, and 20,000 cubic yards from Essex Shoal. Disposal of dredged material will be accomplished by point dumping in Long Island Sound approximately 1/2 mile southwest of the charted Cornfield Shoal disposal area.

3. Environmental Impacts:

Potential environmental impacts associated with the proposed action include both short term and long term effects. Short term effects are mainly associated with physical, chemical and biological impacts at both the dredge and disposal sites. These include (1) loss and disruption of benthic communities, (2) temporary release of suspended solids, nutrients, and chemicals in the water column, and (3) temporary losses in water quality and aesthetic value of the water column. Longer term impacts are related mainly to continued use of water resources for economic and recreational purposes. They include (1) maintenance of recreational boating in North Cove and surrounding areas, and (2) maintenance of navigation in the Connecticut River

with the advantages of waterborne transportation. Long term impacts to the natural environment will result from future periodic maintenance of the project areas.

4. Alternatives:

Four land sites in the Old Saybrook area were considered as potential disposal sites for the dredged material from North Cove. All four sites were found to be deficient, and therefore were not considered feasible alternatives. No land sites were available for disposal of dredged material from Brockway Bar or Essex Shoal. In addition, several open water disposal areas were considered and found to be less desirable than the site finally selected.

# 1.0 PROJECT DESCRIPTION

## 1.1 Purpose

The proposed project will alleviate existing shoaling at North Cove in Old Saybrook, Connecticut and Brockway Bar and Essex Shoal in the Connecticut River below Hartford.

## 1.2 Background

There have been many reports dating back to 1837 on the Connecticut River relative to improvement for commercial navigation. In general, these reports have covered improvements at particular localities or bars in the river such as anchorages and access channels, and improvements for commercial navigation to Hartford, including channels, dikes, training walls and revetments. The existing project consists of two riprap stone jetties at the mouth of the river, the tops being 5 feet above mean high water and 6 feet wide, being 2,300 and 2,750 feet long, east and west respectively (River and Harbor Act of 10 June 1872); a training dike about 3,700 feet long at Hartford (River and Harbor Act of 3 March 1881); a channel 8 feet deep, 75 feet wide and 1.5 miles long in Eight Mile River, from the Connecticut River to Hamburg, with an 8-foot turning basin 150 feet wide and 300 feet long (River and Harbor Act 25 June 1910); a channel 15 feet deep and 300 feet wide from Long Island Sound to Lyme Railroad Bridge about 3.4 miles (River and Harbor 27 February 1911), thence 15 feet deep and 150 feet wide to Hartford, about 48.6 miles

(River and Harbor Act 30 August 1935), resulting in a total distance of 52 miles; the construction of training walls, dikes, revetments and accessory works from the mouth to Hartford (River and Harbor Act 2 March 1919); anchorages 11 feet deep about 11 acres, and 6 feet deep about 17 acres in North Cove, Old Saybrook, with an entrance channel 11 feet deep and 100 feet wide (River and Harbor Act 2 March 1945); Essex Cove Channel, 10 feet deep, 100 feet wide and about 4400 feet long adjacent to the Essex waterfront, with a 10 foot deep anchorage about 15 acres bounded by 10 and 15 foot channels, and an anchorage of aobut 19 acres 8 feet deep bounded by the same 10 and 15 foot channels, (River and Harbor Act 14 July 1960, Section 107); and a 6 foot channel into Wethersfield Cove 60 feet wide leading to a 6 foot anchorage of about 30 acres (River and Harbor Act 14 July 1960, Section 107).

The foregoing depths refer to mean low water. Mean tidal range is 3.5 feet at mouth and about one foot at Hartford. Total actual Federal costs for construction and maintenance of the Connecticut River navigation project from its mouth to Hartford is approximately $7,200,000 through Fiscal Year 1976.

## 1.3 North Cove

North Cove is located in Old Saybrook, Connecticut about 14 miles west of New London near the mouth of the Connecticut River. It consists of a small embayment covering about 150 acres (Figure 1),

CORPS OF ENGINEERS

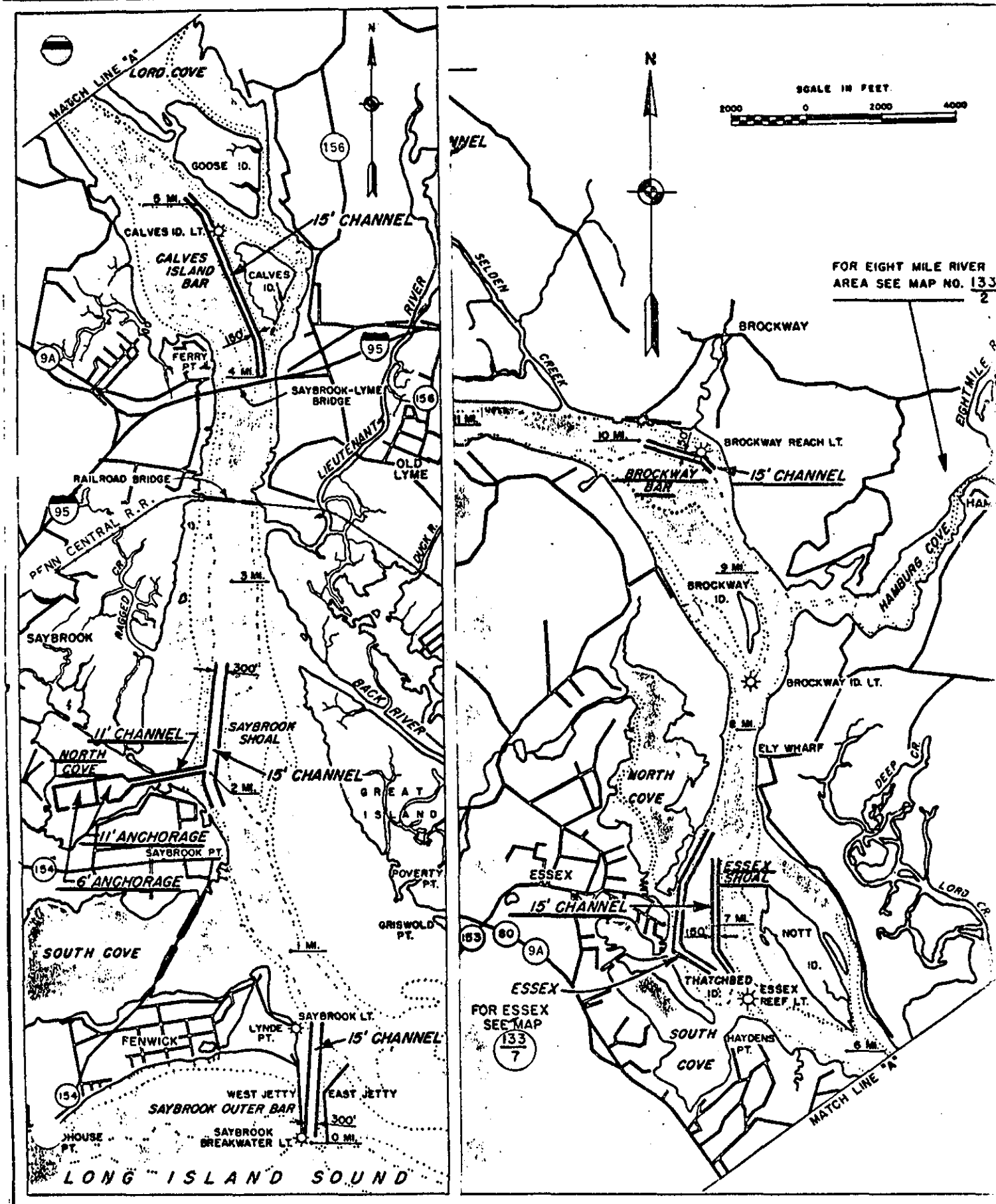



FIGURE 1

and is almost completely isolated from the Connecticut River by an abandoned railroad embankment approximately 3,000 feet long. Except for the embankment, North Cove is bordered primarily by tidal marsh.

The authorized Federal project in North Cove consists of an entrance channel 1,900 feet long, 100 feet wide and 11 feet deep leading to an anchorage area of the same depth about 800 feet long by 650 feet wide covering about 11 acres. Beyond this anchorage is a second anchorage, six feet deep, 1,150 feet long, and 650 feet wide, covering about 17 acres and extending nearly to the west shore of the Cove.

North Cove was initially dredged in 1965 at which time the authorized dimensions were provided. Project construction involved removing approximately 535,000 cubic yards of material, primarily sand, which was placed in the Cornfield Shoal disposal area in Long Island Sound. Shoaling since 1965 has reduced available depths in North Cove to the extent that vessels cannot safely navigate at all stages of tide. The proposed maintenance will consist of removing and disposing of approximately 110,000 cubic yards of material to restore the project to a useful and accessible condition. Hydrographic surveys have shown controlling depths to be as follows: 11-foot entrance channel-4.2 feet; 11-foot anchorage-4.5 feet; 6-foot anchorage-5.2 feet. Under the proposed dredging project, the 11-foot channel and 11-foot anchorage area will be dredged to a depth of eight feet and the six-foot anchorage will be dredged to six feet. Although not

entirely to authorized depths, the proposed depths will meet the needs of vessels currently utilizing the project.

## 1.4 Connecticut River Below Hartford

Brockway Bar and Essex Shoal are upstream from North Cove and in the mainstem of the Connecticut River. Brockway Bar is approximately at river mile 10 and Essex Shoal is approximately at river mile 7. (See Figure 2). Both of these river bar channels have authorized dimensions of 15 feet deep at mean low water and 150 feet wide.

Dredging of the various bar channels in the Connecticut River main channel, including Brockway Bar and Essex Shoal, has been performed since the 1930's. This irregularity of dredging is due to inconsistencies in the cause of shoaling, which is primarily suspended materials carried down the river during spring freshets. A maintenance dredging contract is generally awarded bi-annually to restore the most seriously shoaled channels to authorized dimensions. Tankers and towboats having drafts of 12 feet require full project depth of 15 feet, mean low water, to travel the 52 miles from Long Island Sound to Hartford without encountering costly tidal delays and potential hazards. Vessels drawing more than 12 feet face tidal delays since they require greater than project depth to allow for a buffer between the bottom of the vessel and the channel bottom; these delays, and the resulting costs, are minimized if project depths are available.

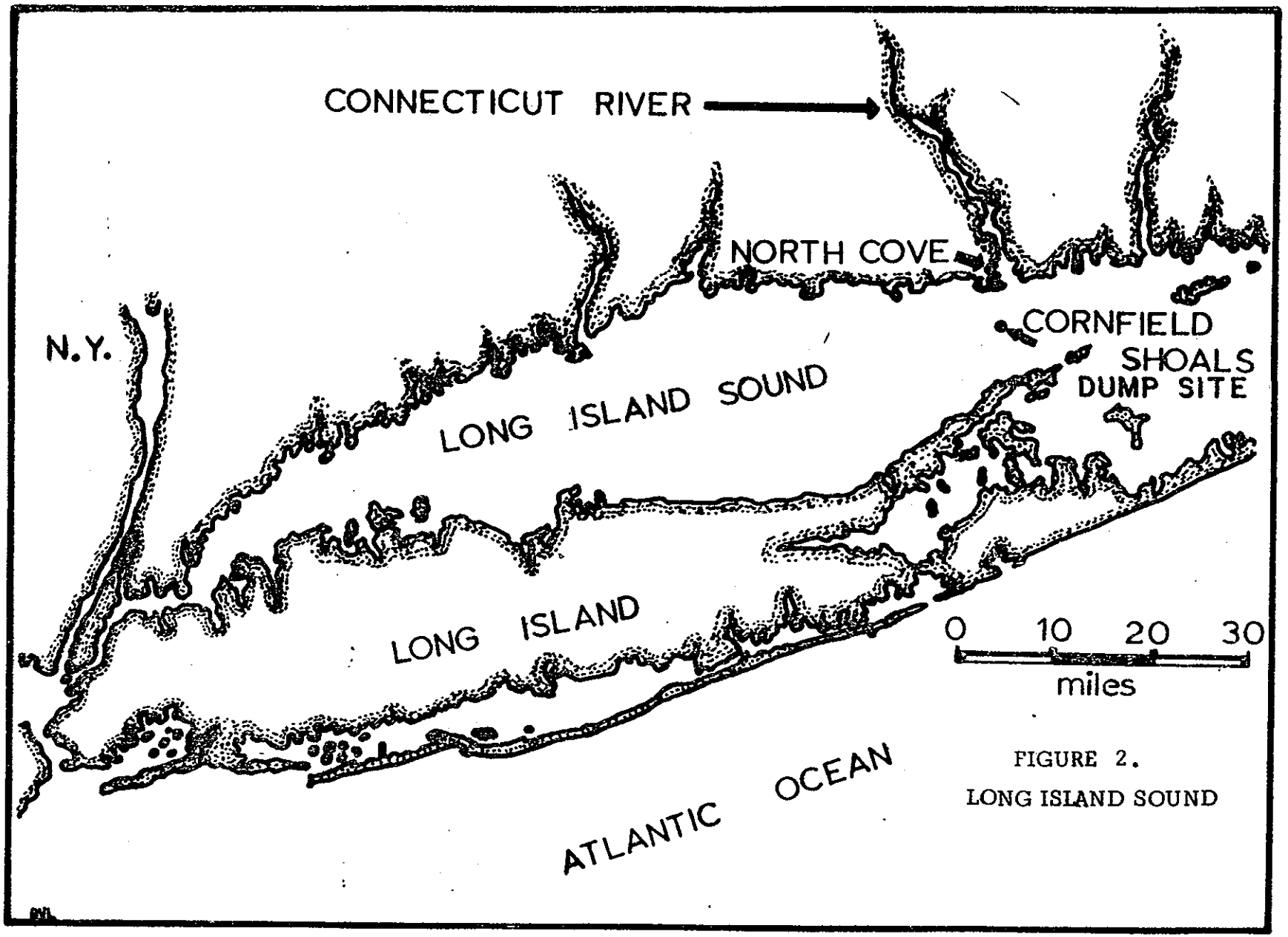



FIGURE 2.
LONG ISLAND SOUND

Dredging is proposed at Brockway Bar and Essex Shoal to restore these portions of the Federal channel to authorized dimensions. Depths of 12.5 feet (Brockway Bar) and 13.2 feet (Essex Shoal) are now creating delays and potential hazards for shipping in the river. The proposed work will involve the removal of approximately 23,000 cubic yards of material at Brockway Bar and 20,000 cubic yards at Essex Shoal.

## 1.5 Order of Dredging and Disposal

The proposed project calls for performing dredging and disposal of North Cove sediment starting in September 1976. When all work at North Cove has been completed, dredging and disposal of material at Brockway Bar and Essex Shoal will be performed. This order of work has been selected to allow "capping" the organic silt from North Cove with coarser-grained granular material from the Connecticut River bar channels. This approach is in conformity with recommendations made by the National Marine Fisheries Service.

## 1.6 Disposal Area

Is is proposed that the 153,000 cubic yards of material from North Cove, Brockway Bar and Essex Shoal be hauled in scows and dumped at an open water disposal area which is an extension of the existing Cornfield Shoal Dumping Grounds in Long Island Sound. This area is one nautical mile square (with sides running true north-south and east-west) the center of which is 5,930 yards from Saybrook

Breakwater Light on a true bearing of 198° 15'. Point dumping will be employed in disposal operations with the point located at 41° 12.6' N, 72° 21.6'W; or 6,650 yards from Saybrook Breakwater Light on a true bearing of 194° from the Light. The point is over a natural depression that is approximately 170 feet deep.

## 1.7 Relationships With Other Projects

The proposed project includes coordination of dredging activities at North Cove, Brockway Bar and Essex Shoal. In addition, disposal of material dredged from these sites has been considered in relation to proposed and projected dredging and disposal from other sites. Details are furnished in Section 4.4.

Other relationships center on legislation covering environmental conservation and protection. The proposed project is coordinated with the specifics of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500; 86 Stat. 816), the Marine Protection, Research and Santuaries Act of 1972 (Public Law 92-532; 86 Stat. 1052), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Finally, this project is coordinated with appropriate Federal, State and local agencies. Additional details are available in Section 9.0 of this report.

# 2.0 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

## 2.1 Connecticut River

The Connecticut River, the largest river in New England, begins in the northern portion of New Hampshire and flows south to Long Island Sound, a distance of approximately 409 miles. At Old Saybrook, Connecticut, the river enters the Sound, and is the most conspicuous indentation of the shoreline. Tidal effects reach upstream to Hartford, Connecticut, a distance of 52 miles.

The Connecticut River from Hurd State Park in East Hampton to the river mouth (shellfish closure line) was classified as Class SC by the Connecticut Department of Environmental Protection (Conn. DEP) in 1973. Water quality conditions in 1976 are expected to be Class SB. Present conditions are considered suitable for fish, shellfish and wildlife habitat; for recreational boating and industrial cooling; and for good aesthetic quality.

The Connecticut River provides suitable habitat for aquatic wildlife, including various finfish species. In recent years cooperative efforts between State and Federal agencies have included the restoration of anadromous fish in the river.

Bordering the Connecticut River between Long Island Sound and Hartford are 17 cities and towns having an estimated population of 500,000; however, the population that is served by the existing commercial navigation channel to Hartford is estimated at 1.3 million. The area bordering the river is a rich farming and industrial

region, and the cities of Hartford and Middletown are large industrial centers manufacturing a wide variety of projects.

The principal terminal and transfer facilities are located at Middletown, Portland, Wethersfield, East Hartford and Hartford. The power company terminals at Middletown and Hartford have been modernized to provide for storage of oil as a fuel for power production replacing the former coal handling and storage facilities. There are seven yacht clubs and seven boat clubs located along the river between the mouth and Hartford; 12 boatyards and 34 marinas provide service for boats ranging from small skiffs to large yachts.

Waterborne commerce on the Connecticut River to Hartford increased 42% during the period 1960-1974, from 2,556,308 to 3,633,458 tons. This commerce consisted primarily of petroleum and petroleum by-products shipped from New York and other nearby ports. Ferry service on the river below Hartford carried 343,317 passengers in 1974, with an additional 108,934 automobiles accompanying passengers.

During 1974, a total of 58,377 commercial vessel trips were reported having a maximum draft of 18 feet. Approximately 2/3 of the total commerce is transported on vessels and barges having drafts greater than 12 feet. Although nearly one third of the vessels used to deliver petroleum products are small coastwise tankers which navigate on flood tide to pass over shoaled areas in the existing channel, these tankers are being phased out in

favor of barges of 4,000 ton capacity drawing 14 feet. Barges are a more economical means of transporting oil to meet the needs of terminals scattered along the river because the towboats are able to leave the barges for loading and unloading, thus eliminating the cost of in-port time incurred by the tankers.

Failure to maintain the Connecticut River navigation channel to Hartford will have a severe economic effect on the region being serviced by waterborne traffic. In addition, the potential will increase groundings and collisions with the possibility of oil spills. Alternatives will be to transport oil by various modes of transportation--railroad tank cars, pipelines or trucks. The use of railroad tank cars from the point of origin or from intermediate retailing points will require the purchase of numerous new tank cars, the acquisition of new lands, if available, and the development of sidings on the transportation route. Also, more hired help would be necessary to handle the increased workload, and intermediate delivery points would entail more storage and rehandling facilities resulting in higher costs. Many oil company storage tanks in the East Hartford area are located far from rail facilities thus negating direct transfer. Therefore, either rehandling by truck or pipeline would be required from freight yards, or existing storage facilities would have to be relocated.

Direct delivery by truck from refineries or intermediate rehandling points would be even more costly due to the much smaller quantities which could be delivered per trip. The use of pipelines

would entail initial construction of such lines to existing facilities. One problem to be encountered would be the requirement for steam-jacketed pipelines to permit pumping of high viscosity residual oil during cold weather. This type of pipeline would be extremely expensive to construct. The number of pipelines would be high to separate the transportation of various types of products. Direct delivery by barge is the most economical method of transporting petroelum products to outlets on the Connecticut River.

## 2.2 Old Saybrook Area

Old Saybrook is located in Middlesex County in south central Connecticut, at the mouth of the Connecticut River. It is bounded on the west by the Town of Westbrook, on the north by Essex, and on the east by the Connecticut River. Old Lyme lies to the east across the river, and the town is bordered by Long Island Sound to the south.

As with most communities bordering Long Island Sound, Old Saybrook has experienced steady growth in recent decades. The population was 2,499 in 1950; 5,247 in 1960; and 8,468 in 1970. Current population is over 9,000 (State of Connecticut, 1973). Old Saybrook is 42 miles south of Hartford, Connecticut; 110 miles east of New York City, and 115 miles southwest of Boston, Massachusetts. Other major metropolitan areas within 100 miles include Bridgeport and New Haven, Connecticut, Springfield and Worcester, Massachusetts and Providence, Rhode Island.

Old Saybrook is an important resort community. Approximately one-third of the dwellings are seasonal, and many are available for short term or summer rental. Access to the water and the beach and ocean environment, make aquatic recreation an important feature. Yachting is a favorite activity (Old Saybrook Chamber of Commerce, 1973).

Industrial development of the shore areas has been kept to a minimum, although the town does welcome new sources of jobs and products. The area is serviced by rail, airplanes and highway. Retail and service establishments have increased with population; however,, the town is not highly commercialized. Industry is represented by approximately 40 establishments that cover a wide range of products and services, including boat building and repairs; commercial printing; furniture; electronic equipment; plastics and timing devices (Old Saybrook Chamber of Commerce, 1973).

## 2.3 North Cove

Description - North Cove is a shallow embayment near the mouth of the Connecticut River at Old Saybrook. Surface area of the cove is approximately 150 acres.

The area around North Cove is particularly scenic. The cove is bounded on the north side by an artificial fill that separates the Cove from an extensive salt marsh and tidal pond. To the west and south, the land area is divided into estates and small family

dwellings. The homes are well cared for, as are the land properties surrounding the Cove. The public boat ramp (south shore) is also in good repair. The Cove and numerous sail and motor craft provide high aesthetic value from all points. Several of the nearby homes are also very old, and can be considered valuable historical resources in Old Saybrook. Water aesthetics are good considering the sheltered nature of the Cove.

As previously stated, shoaling has reduced water depths at mean low water to 4.2 feet in the entrance channel, 4.5 feet in the 11-foot anchorage and 5.2 feet in the 6-foot anchorage. Statistics of applications for mooring space in North Cove since 1972 show that an average of about 55% of the vessels involved have drafts exceeding four feet (Study of Connecticut River Below Hartford, North Cove, Old Saybrook, Connecticut, 1974; and personal communication, Dr. Mauriac, 1976). The number of applications received for each year since 1972 has exceeded the number of vessels which can be accommodated (about 150). Failure to implement the proposed project will perpetuate unsafe navigation conditions for vessels using the Cove and, combined with continued shoaling, will lead to the project's becoming inadequate for most of the vessels now using it.

Fish and Shellfish Resources - Prior to 1965, only eels were reported to inhabit the North Cove. Today, many fish are being caught in the Cove. These include bluefish, striped bass, weakfish and menhaden, all of which have significant economic and recreational value. Perch and catfish have also entered the Cove. Eel are now

caught in approximately the same numbers as before the original dredging in 1965 (Squires, August 8, 1975). It follows that these species, plus shad during the spawning seasons, inhabit various sections of the Connecticut River.

Bottom dwelling invertebrates, in particular crabs, have been reported in the Cove in increasing numbers (Squires, August 8, 1975). The increase in crab and fish populations indicate a probable increase in benthic micro- and macro-invertebrates, and other marine organisms since these are food sources for higher forms of vertebrates.

Water Quality - Water quality in North Cove has been designated Class SCc which is suitable for fish, shellfish, and wildlife, recreational boating and industrial cooling. It has good aesthetic quality. Bacteria such as coliform are present in North Cove. The 1975 Bathing Beach Study (Conn. State Department of Health) shows that no coliform organisms are present in sufficient quantities to classify the Cove water as good to fair (70-400 organisms/100 ml). The entire Connecticut River mouth is classified as fair, with an average coliform count of 353 organisms/100 ml.

## 2.4 Long Island Sound

Long Island Sound lies between 40° 50' N and 41° 20' N latitude and 72° W and 73° 31' W longitude, and is a semi-enclosed system between Long Island, New York and Connecticut. The western end is contiguous with New York Harbor, while Fisher's Island delimits the eastern end from Block Island Sound. The Sound is about 90 nautical miles long, has a maximum width of 15 miles, and an area of 928

square nautical miles (Riley, 1955). The greatest depths, 325 feet, (100 meters) are found in the eastern end, and decrease to depths of 108 feet (35 meters) in the central and western portions of the Sound. Mean water depth is 62 feet (20 meters).

The Sound experiences the same semi-diurnal cycle as does the Connecticut River estuary. Tidal amplitude ranges from a maximum of 2.5 feet (0.8m) in the area of the eastern end to 7.3 feet (2.3m) at the western end (ESSA, 1974). Depths at the disposal site range from 160 to 172 feet at mean low water.

## 2.5 Analyses of Bottom Sediments

EPA 1975 Guidelines (Federal Register, Vol. 40, NO. 173 - Friday, 5 September 1975) offer guidance on general approaches for technical evaluation of ecological effects from dredged material discharges. The Guidelines state: "No single Test or approach can be applied in all cases to evaluate the effects of proposed discharges of dredged or fill material. Evaluation of the significance of physical effects often may be made without laboratory tests by examining the character of the dredged or fill material proposed for discharge..."

Sediment samples obtained from the Connecticut River, by the Corps of Engineers, in September and March 1974 showed that the material is predominantly medium to fine sand at Essex Shoal and fine sand at Brockway Bar. The material is classified as unpolluted according to Environmental Protection Agency criteria. Grain size analyses of sediment from Essex Shoal and Brockway Bar are contained in Appendix A.

The Corps of Engineers has conducted both sedimentological (April, 1975) and standard elutriate (January, 1975) tests on sediments found in North Cove. Data are summarized in Tables 1 and 2.

Sediment analysis (Table 1) indicates that the sediment in North Cove is composed of silty-fine sand or silt, organic debris, and shell fragments. Sediments within the anchorage area are basically organic silts grading to organic silty fine sands in the entrance channel. Average median grain size is 0.037 mm. These sediments are not characteristic of a high water energy system. Reducing conditions (anerobic) exist in North Cove as indicated by the visual analysis of sediment cores by the Army Corps of Engineers, NED, (1975). Also noted was the presence of a strong "marine" odor characteristic of reducing conditions.

A standard elutriate test was performed on sediments found at North Cove and water sampled from the Cornfield Shoals Dumping Ground.

## 2.6 Disposal Site

The proposed disposal site is in an extension of the Cornfield Shoal Dumping Grounds is an area one nautical mile square (with sides running true north-south and east-west), the center is 5,930 yards from Saybrook Breakwater Light on a bearing of 198° 15' true. The specific dumping point within this area is located at 41° 12.6' N, 72° 21.6'W or 6,650 yards from Saybrook Breakwater Light on a bearing of 194° true from the Light.

Acoustic sub-bottom profiles have been made of this area by Yale University (Bokuniewicz, personal communication). While there

TABLE 1.

Sediment Analysis

North Cove, Old Saybrook, Connecticut

| Parameter | Sampling Stations | | | Mean |
|---|---|---|---|---|
| | PE-1 | PE-2 | PE-3 | |
| Visual Classification | Black Organic Silt | Black Organic Silty Fine Sand and Sandy Silt | Black Organic Silt | |
| Median Grain Size (mm) | 0.0150 | 0.0800 (0.0430) | 0.0160 | 0.037 (0.043) |
| Vol Solids - EPA % | 8.0 (8.8) | 4.1 (6.2) | 8.8 (12.3) | 6.97 (9.1) |
| Vol Solids - NED % | 6.5 | 2.6 | 7.0 | 5.37 |
| C.O.D. % | 11.0 | 5.45 | 11.9 | 9.45 |
| T.K.N. % | 0.278 | 0.119 | 0.350 | 0.249 |
| Oil and Grease % | 0.351 | 0.254 | 0.335 | 0.313 |
| Mercury $X10^{-5}$ % | 3.9 (5.8) | 1.8 (4.3) | 4.4 (4.3) | 3.37 (4.80) |
| Lead $X10^{-3}$ % | 9.8 (9.7) | 7.5 (7.7) | 7.2 (10.6) | 8.17 (9.33) |
| Zinc $X10^{-3}$ % | 24.6 (24.8) | 12.9 (20.3) | 27.0 (25.9) | 21.5 (23.67) |
| Arsenic $X10^{-3}$% | 0.73 (0.65) | 0.35 (0.38) | 0.60 (0.68) | 0.56 (0.57) |
| Cadmium $X10^{-3}$ % | 0.87 (0.77) | 0.42 (0.61) | 0.60 (0.59) | 0.63 0.66 |
| Chromium $X10^{-3}$ % | 8.7 (9.7) | 4.6 (6.9) | 9.6 (10.6) | 7.63 (9.06) |

(Continued on Next Page)

TABLE 1. (Continued)

| Parameter | Sampling Stations | | | Mean |
|---|---|---|---|---|
| | PE-1 | PE-2 | PE-3 | |
| Copper $X10^{-3}$ % | 14.2<br>(12.6) | 5.8<br>(7.6) | 10.8<br>(10.6) | 10.27<br>(10.27) |
| Nickel $X10^{-3}$ % | 6.5<br>(5.8) | 4.2<br>(3.8) | 7.2<br>(5.9) | 5.97<br>(5.17) |
| Vanadium $X10^{-3}$ % | 5.4<br>(4.8) | 4.2<br>(3.8) | 6.0<br>(5.9) | 5.20<br>(4.83) |
| Total Carbon % | 3.50 | 1.56 | 3.55 | 2.87 |

Notes: Values shown are percent of samples dry weight. Concentrations in Parentheses are derived from 1.17 ft. depth of core.

TABLE 2.

New England Division, Corps of Engineers, U. S. Army.
Report of The New England Division Materials Testing Laboratory, Water and Sediment Testing. Standard Elutriate Test. North Cove, Old Saybrook, Conn. and Cornfield Shoals Dumping Grounds. January, 1975.

| Test Property (2) (3) | Water At Dumping Ground (EW-1) | Standard Elutrient Designation and Depths of Sediment Used in Shake Test (1). | | | | | |
|---|---|---|---|---|---|---|---|
| | | North Cove (PE-1) | | North Cove (PE-2) | | North Cove (PE-3) | |
| Depth of Sample | -136.0' | 0-2" | 12-14" | 0-2" | 12-14" | 0-2" | 12-14" |
| Nitrite (N), mg/l | < 0.010 | 0.012 | < 0.010 | 0.010 | 0.011 | < 0.010 | < 0.010 |
| Nitrate (N), mg/l | 0.14 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Sulphate ($SO_4$), mg/l | 1,400 | 1,200 | 1,200 | 1,150 | 1,125 | 1,175 | 1,050 |
| Orthophosphate (P), mg/l | 0.045 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | 0.020 | < 0.010 |
| Total Phosphate (P), mg/l | 0.050 | 0.095 | 0.117 | 0.105 | 0.047 | 0.097 | 0.155 |
| Freon Soluble, mg/l | 1.7 | 4.0 | 0.0 | 3.6 | 3.8 | 10.8 | 0.0 |
| Mercury (Hg), µg/l | 0.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| Lead (Pb), µg/l | < 4 | < 4 | < 4 | 4 | < 4 | < 4 | < 4 |
| Zinc (Zn), µg/l | 26.0 | 17.5 | 18.5 | 20.0 | 12.5 | 11.0 | 9.5 |
| Arsenic (As), µg/l | 3 | 11 | 9 | 9 | 11 | 9 | 11 |
| Cadmium (Cd), µg/l | 3.5 | 1.0 | < 1.0 | 5.0 | 1.0 | 1.0 | < 1.0 |
| Chromium (Cr), µg/l | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| Copper (Cu), µg/l | 13 | 10 | 10 | 15 | 8 | 15 | 10 |
| Nickel (Ni), µg/l | 14 | 14 | 17 | 20 | 23 | 17 | 8 |
| Vanadium (V), µg/l | <8 | <8 | <8 | < 8 | < 8 | < 8 | < 8 |
| Visual Analysis | - | Dark gray organic silt (OL) with marine odor. | | Dark gray organic silty-fine sand (SM) w/marine odor. | | Dark gray organic silt (OL) with marine odor. | |

TABLE 2. (Continued)

Results of Tests Performed on (1) Standard Elutriate Resulting from the "Shake" Test Using 1 Part Bottom Sediment from Various Sampling Locations with 4 Parts Water from Dumping Ground, and (2) the Virgin Water.

Notes: (1) Elutrient Designations PE-1, etc. Correspond to Location of Sediment Samples with Exploration No. Shown on Sheet.

(2) All Tests Performed by NED Laboratory Personnel in Accordance with Current Accepted EPA Procedures.

(3) Reference is Made to Paragraph 227.61(c), Federal Register, Dated October 15, 1973, Volume 38, No. 198, Part II, EPA, Ocean Dumping, Final Regulations and Criteria which States: "Dredged Material May be Classified as Unpolluted if it Produces a Standard Elutrient in Which the Concentration or No Major Constituent is More Than 1.5 Times the Concentration of the Same Constituent in Water from the Proposed Disposal Site Used for Testing."

are no sediment analyses of the specific point in question, the bottom is in a region of silty sand which extends westerly south of Long Sand Shoal. This indicates the area is relatively inactive in terms of benthic life and current velocities. Sand is not a good habitat for most benthic organisms and silty sand would be washed away by strong currents.

It is assumed that nearly all of the approximately 100 finfish species known to inhabit Long Island Sound can be found in the general area. Therefore many of these species would be found at the disposal site. The specific disposal point is south of significant shellfishing and lobstering activity. Although there may be shellfish and lobster in the general area, the depth of the disposal site precludes concerted fishing activity for these species.

The area is considered a desirable location for long-term disposal of material dredged from areas along the Connecticut shoreline between Black Point west of Niantic Bay and Hammonasset Point west of Clinton Harbor. Available information indicates that disposal operations here would present the least interference with the biological community and with other activities of man. The Environmental Protection Agency has expressed the opinion that the number of dredged material sites should be held to a minimum until sufficient information exists to adequately assess the impacts from this activity. No more detailed information exists for choosing a better alternative site to conform with that objective.

## 2.7 Summary

The proposed dredging project areas are located in North Cove in the Town of Old Saybrook, Connecticut, and in two sections of the mainstem of the Connecticut River. The Connecticut River is a valuable natural resource. The Old Saybrook area is a region of historical, cultural and recreational value. The proposed project also includes the previously described point in Long Island Sound as a disposal site.

Much recreational activity in the area centers on the aquatic environment. Boating and yachting are important activities, and contribute to the recreational and economic resources of the Old Saybrook area. Safe navigation in North Cove and the Connecticut River is important to the economic, recreational and aesthetic resources of the region.

## 3.0 RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS

Land areas adjacent to the proposed project areas have already been dedicated to water related activities, such as recreational boating and waterborne commerce. Maintenance dredging is in keeping with these activities and will serve to preserve them.

The activities of recreational vessels in North Cove and commercial vessels in the Connecticut River are of major significance. If the present level of economic and recreational activity resulting from boat moorings in North Cove is to be maintained, it is necessary that adequate depths in the Cove entrance channel and anchorage be maintained. Maintaining the Connecticut River channel to authorized dimensions will help to insure that the regional economy based on waterborne commercial traffic is maintained, and this will help to eliminate delays and potential hazards being experienced by commercial navigation.

The Old Saybrook area is a valuable cultural and historical resource. Preservation of the general area for recreation, scenic, and cultural resources is recommended in recent reports (NERBC, 1973, 1974). The proposed project, in providing for the continuation of recreational potential of the area, is consistent with the broad objectives of such plans. Inasmuch as disposal will be in open water, the project does not relate to the use of land as disposal sites.

# 4.0 THE PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

Environmental impacts associated with the proposed project are divided into those impacts related to dredging and those related to disposal of the dredged materials. These impacts may be subdivided into physical, chemical, and biological aspects at each site. The proposed project also will have impact on socio-economic conditions in the area and on the aesthetics at each site.

## 4.1 Dredging Operations

Dredging will remove and alter the substrate used by various estuarine biota. The area most affected will be that covered by the path of the clamshell dredge. In North Cove this amounts to approximately 20 acres or about 13% of the entire Cove, and 3 acres outside the Cove entrance. Brockway Bar constitutes an area of approximately 7 acres, and Essex Shoal an area of approximately 11 acres. Areas outside the dredge path will be affected somewhat by the suspension and deposition of dredged materials during dredging operations. Dredging operations will probably introduce materials of similar, fine grained composition into the rest of the river estuary and Long Island Sound. Prevailing winds and water current patterns as well as tidal cycles are factors in determining the extent to which suspended matter and high turbidity levels of natural origin will travel, and the duration of such phenomena; they will likewise influence suspended matter generated by dredging. In general, increase in suspended materials from the dredging will be of short duration and is not considered likely to

impact areas away from the actual work sites more significantly than levels of suspended material generated by natural forces during high runoff periods. Thus, the impact of dredging operations on water quality in North Cove as well as the Connecticut River is expected to be minimal.

A review of results from recent research efforts concerned with the release of heavy metals and potentially toxic compounds, during dredging and disposal operations leads to the conclusion that the potential for such releases, and thus for subsequent environmental damage, is slight.

The most obvious effect on biological communities will be the physical destruction of those communities in the path of the dredge. As the benthic (bottom) habitat is destroyed, organisms will be either destroyed or redistributed. The extent of this impact will depend on the mobility, nutritional characteristics, diversity, and productivity of the biota in the area in which dredging and settling occurs. (McCauley et al. 1976). Maximum impact will be localized in the areas to be dredged. By the time the water reaches the Sound, the sediment load should not exceed that normally experienced at times of peak suspended matter.

The release of particulates, potentially toxic compounds, and nutrients can have both detrimental and beneficial effects on phytoplankton. Increased amounts of suspended matter will temporarily increase turbidity, and thus decrease light penetration into the water column. Phytoplankton depend physiologically on light and suspended nutrients to manufacture organic compound. Variations in light from

normal levels can affect photosynthesis, productivity, diversity, density and community structure of phytoplankton. Nutrient release, on the other hand, can cause temporary phytoplankton "blooms" which may eventually result in deteriorating water quality. The zooplankton community composition and density would be expected to parallel that of the phytoplankton since zooplankton consume densities of phytoplankton and zooplankton in areas immediately adjacent to the dredge path. Although such a release is not probable (Lee et al., 1975, Chen et al., 1976). Further, the small planktonic organisms have rapid reproductive capacities, and any reductions in their population would not be a long term impact.

The proposed dredging is not expected to produce any short or long-term deterioration in the aesthetic quality of North Cove, Brockway Bar or Essex Shoal. These areas have been dredged previously without any deleterious effects noted.

## 4.2 Disposal Operations

Disposal of the dredged sediments will produce several impacts, centering on the effects of sediment deposition and the accompanying rise in turbidity in the water column.

The degree of impact suspended matter has at the disposal site depends largely on the length of time the material is in suspension after being discharged into the water. Hollman et al., 1975, determined that turbidity caused by dumping is a short-term event, and a return of turbidity levels to near ambient conditions are observed shortly after dumping. Gordon, in a study of the New Haven Dumping Ground

Heavy metals released to the water column is considered a relatively short-term event (Lee et al., 1975, Chen et al., 1976). Soderberg, Bruno, 1971, concluded that "mercury concentrations in fresh surface waters, dissolved or suspended, are rapidly reduced due to sorption and by complexing reactions with clays, plankton, colloidal proteins, humic materials and other organic and inorganic colloids." Although the chemical properties of heavy metals in seawater are not necessarily the same, it is expected that similar chemical phenomena will aid in reducing concentrations of heavy metals within the water column with time, again reducing remote and cumulative impacts. Results of laboratory investigations conducted at the University of Southern California by Chen (1976) produced the conclusion that "concerns regarding the release of any significant quantity of toxic materials into solution during dredging operations and disposal are mostly unfounded." Further, the overall conclusion of the chemical oceanographic monitoring of the Navy's disposal of 1.5 million cubic yards of material at New London is, "no major changes attributable to dumping has yet been detected in the water or sediments,"

No site specific information is available on the extent and diversity of benthic life at the disposal site. Deposition of sediments on the benthic substratum will result in destruction of various benthic biota in the immediate area of disposal operations. Benthic invertebrates adapted to burrowing may migrate vertically to the surface, while other may not survive. Smaller, less mobile infaunal forms and surface dwelling invertebrate species may also be destroyed.

Long Island Sound concludes that "99% of non-cohesive spoil of high silt content discharged from a scow in the presence of a tidal stream is transported to the bottom as a high speed turbulant jet." Gordon's study indicated that the material does not fall as individual particles but is carried very rapidly to the bottom as a 'density current.' This implies that the environmental impacts associated with the discharge of dredge materials should be minimized by the limited contact time available to pollutants traversing the water column. The relatively low energy level believed to exist at the disposal site should limit the extent and severity of remote impacts following disposal. Single dump events can be expected to produce small impacts as their turbidity plumes leave the site and disperse; these impacts, as shown by monitoring efforts in connection with Navy disposal operations at the New London Disposal Area, are short-lived and not severe.

Studies conducted in Elliott Bay, Washington demonstrated that the initial surge of material leaving the barge settles from the water column very quickly, becoming undetectable within 10 minutes after disposal and that a very small amount of material is placed in suspension at the water surface aside from minor surface turbidity the effects of disposal were detected only within 25 meters of the bottom. This material remained in suspension for about 2.5 hours after disposal.

The complex chemistry of suspended particulates, compounds and elements is poorly understood, and is peculiar to each set of circumstances. The potential does exist for degradation of water quality and bottom sediments at the disposal site owing to the introduction of North Cove sediments. In light of recent research, this potential is considered to be remote.

The finfish community in the area and other mobile species such as crabs and lobsters will be able to avoid burial by sediments.

The physical aspects of disposal operations (e.g., siltation and temporary high turbidity) may interfere with the respiration of marine organisms (Saila et al., 1971). Attached benthic forms may suffocate, while respiratory damage may occur in mobile forms. It is generally accepted that fish can withstand high concentrations of suspended sediments for short periods without critical effects. A recent laboratory study (New England Aquarium, 1974) indicated that the effects of turbidity may be sub-lethal for certain benthic forms. As previously indicated, high levels of turbidity from disposal operations are of short duration. Bocuniewicz et al., (1974) found that the turbidity "cloud" settles rapidly after disposal, and that 26 minutes after disposal the turbidity in the water column approaches pre-disposal levels.

Aesthetics in the disposal area may be temporarily degraded by the increased amounts of suspended particles in the water column. This impact will be short-term, and should not vary significantly from the normally high sediment load of Long Island Sound waters.

Temporarily high concentrations of suspended particles decrease light penetration into the water column and produce a drop in the photosynthetic rate of phytoplankton. This is expected to be a short-term event.

Commercial fishing in the immediate area affected by disposal operations is not known to be a relatively significant activity. In any case, lobsters, crabs, shellfish and finfish are expected to survive

temporary conditions of high turbidity. Populations should return to normal densities shortly after cessation of disposal operations.

## 4.3 Impacts of Project Itself

Impacts identified above center around shorter term effects related to the physical activities of dredging and disposal. It is equally important to identify effects of the project on the human environment.

Continued availability of North Cove to small craft for recreational activities will result from the proposed project. Adequate depth of the channel and anchorage areas will permit continued use of the Cove as a safe port. It is the nearest protected anchorage to Long Island Sound in the Connecticut River. Utilization of the recreational potential of the area will be maintained by the project. Economic benefits to the Town of Old Saybrook resulting from the use of the North Cove anchorage are recognized by the Old Saybrook Economic Development Commission. (Letter dated March 30, 1976).

Another significant impact of the proposed project is maintenance of navigation in the Connecticut River. Dredging of Brockway Bar and Essex Shoal will maintain those portions of the Connecticut River navigation channel to authorized dimensions, thereby promoting the safe and efficient passage of commercial traffic. Continued use of the river by ships and barges will have the well-recognized advantages in costs and energy utilization per ton-mile for water transport in contrast with land transport.

Although these impacts may be measured in years, shoaling will continue after the proposed project is completed. Thus, the project is

viewed as one step in a long-term (many decades) maintenance program for navigation in the Connecticut River system.

4.4 Cumulative Dredging Impact

It is anticipated that other dredging projects will be performed over the next 10 years in the vicinity of the proposed work. These projects, while not within the scope of the proposed work, are related environmentally in that they are expected to entail disposal at the site selected for the work at hand. The assumption is that this site will prove to be viable as a regional disposal point. The projects, which are expected to generate approximately 1.7 million cubic yards of material by 1986, are summarized below.

Federal Dredging Projects

Connecticut River Below Hartford - Frequency of required maintenance dredging in this project is impossible to forecast due to the variability of shoaling. However, based on prior dredging, it may be anticipated that a total of 250,000 cubic yards of granular material will be dredged over the next 10 years from the five lower bar channels (Saybrook Outer Bar, Saybrook Shoal, Calves Island Bar, Essex Shoal and Brockway Bar). Land-based disposal sites are either non-existent or essentially used to their full capacity. Land-based disposal sites for some of the remaining 28 river bar channels are difficult to obtain, but it is assumed that suitable land sites will be available over the next 10 years.

North Cove, Old Saybrook - A study is under way to evaluate the feasibility of expanding the existing anchorage by approximately 29

acres. No conclusion has been made. If authorized and funded, the work would involve removing and disposing of approximately 300,000 cubic yards of material, primarily sand; the projected time is about 1981.

Projected maintenance dredging at North Cove, assuming that the new work is performed, consists of 100,000 cubic yards in 1981. It is anticipated that the material will be similar to that involved in the present proposed project.

Duck Island Harbor - Projected maintenance dredging consists of 150,000 cubic yards in 1982. Character of material at this project is unknown.

Patchogue River, Westbrook - A study is under way to evaluate the feasibility of widening the existing 75-foot wide entrance channel to 150 feet. If authorized and funded the work would involve removing about 40,000 cubic yards of material, primarily sand, around 1980.

Projected maintenance dredging of this project consists of removing and disposing of about 50,000 cubic yards (25,000 cubic yards in 1981 and 1985) of sand and silt over the next 10 years. Although land disposal areas are currently available, it is assumed that they will be filled to capacity in the near future.

Clinton Harbor, Clinton - A study is under way to evaluate the feasibility of widening and lengthening the existing channel. If authorized and funded the work would involve the removing and disposing of approximately 200,000 cubic yards of material, consisting of both sand and organic matter; timing would be around 1980.

Projected maintenance dredging of this project consists of removing and disposing of 125,000 cubic yards of material, consisting of sand and organic matter, in 1980.

Private Dredging Actions

A permit has been issued to the Northeast Nuclear Energy Company to dredge about 40,000 cubic yards of sand from Niantic Bay and Long Island Sound. The permit provides for placing this material in the Cornfield Shoal Dumping Grounds, probably in 1976. It is likely that the disposal operation will be shifted to the point being considered in this Assessment.

There is a pending permit application on file from the Pilots Point Marina of Westbrook, Connecticut to remove and dispose of approximately 12,000 cubic yards of organic mud from the Patchogue River. The new disposal area will be proposed for this project if a permit is granted. The work would likely be performed in 1977.

In the absence of specific permit requests, it is not possible to forecast future requirements for private dredging other than to project dredging volume requirements based on previous experience. This is admittedly an inprecise approach, but it does allow a contingency for private dredging activity. Past records of permit applications involving material dredged from the area between Black Point and Hammonasset Point and disposal of in open water indicate that a total of 400,000 cubic yards is likely to be involved in similar permit requests over the next ten years. Assuming that permits are granted and the new disposal area proves to be viable for continued use, this new area would be used

for disposal of the material. It is not possible to predict the exact nature of the material that will be involved.

Because of substantial variations in the nature and volume of material involved in projected dredging and disposal operations, both Federal and private, it is not possible to predict impacts with any precision. In general, future projects are expected to have impacts similar to those of the proposed dredging; this work involves materials which span most of the spectrum, as regards contaminant concentrations and physical characteristics, of materials which may be involved in future disposal operations. Because potential future work involves materials which are expected to vary from essentially clean sands to organic silts, "clean" materials will serve to provide successive "caps" over the more contaminated material. The variability of dredging requirements and availability of funds, both public and private, precludes establishing a definite regimen to that end, but there is a high probability that materials of different characteristics will be alternated to a considerable degree at the disposal site.

## 4.5 Scientific Studies of the Disposal Site and Disposal Effects

This Assessment contains references to a number of reports of investigations into dredged material disposal phenomena. There is a continuing interest in this area of science, particularly by concerned Federal and State agencies and in the universities whose research programs have been supported to a large degree by State and Federal grants. It is conceded that a great deal of scientific research remains to be done. The Corps relies on this continuing research as part of the

quest for scientific knowledge and is prepared to change its outlook on dredged material disposal when such change is dictated by scientific inquiry. The consistent return from such studies thus far does not justify adopting a new outlook, but does mandate a continued investigation and surveillance of disposal activities.

Owing to the need for further knowledge on the effects of dredged material disposal, the proposed work includes provisions for studies of the disposal site and its environs before, during and after disposal operations. The proposed studies are comprised of the following elements:

Additional sampling and analysis of North Cove sediments.

Sampling and analysis of sediment from the disposal site.

Detailed bathymetric surveys of the disposal site both before and after disposal operations.

Measuring and recording dispersal characteristics of the material during disposal. This will involve recording the velocity and acceleration of the head of the density current, lateral spreading of the descending jet, velocity and thickness of the bottom surge, and distribution of residual material in the water column.

The study will be conducted by the Corps of Engineers Waterways Experiment Station with participation by Yale University, as part of the Dredged Material Research Program.

## 4.6 Summary of Impacts

Impacts of the proposed project have both short-term and long-term implications. Physical, chemical and biological activities associated with the dredging and disposal operations will have short-term effects on the water column and the benthic community. Longer term effects include the impacts on regional cultural, economic, and recreational resources. The impacts of subsequent dredging operations, while varying in scope on a case-by-case basis, are expected to be similar in nature to those of the proposed work. Table 2 summarizes impacts likely to occur should this project be implemented.

# 5.0 ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Adverse environmental effects which cannot be avoided are mainly short term effects on the aquatic systems directly related to the project.

## 5.1 Water Quality

Dredging operations in North Cove are likely to cause temporary losses in water quality in the Cove. Most of the larger materials will fall out of the water column within a short period (minutes to hours). Finer materials, including true solutes, will stay in the water column for longer periods. The same is true to a lesser degree at the Brockway Bar and Essex Shoal sites. Dredging will temporarily increase the level of suspended materials in the water column where dredging is being performed. These represent short-term impacts which will not permanently affect the environment.

Another adverse effect which cannot be avoided will occur at the disposal site. Disposal of dredged material will result in a temporary loss in water quality; and there will be local burial of the benthic population. Eventually, the system will return to an equilibrium condition.

## 5.2 Aquatic Ecosystems

Adverse effects on aquatic ecosystems will include losses of benthic organisms in the dredge areas. Approximately 13% of the area of North Cove will be affected directly by dredging. Relative

losses of benthic organisms through dredging operations in the Connecticut River will be smaller. Most of the biota and invertebrates found in these areas have high reproductive potentials. As the substrate becomes stable again, recolonization is highly probable.

Disruption of aquatic organisms at the disposal site is anticipated. Although most mobile organisms will be able to leave the area or themselves out of the sediment, sedentary biota will be lost. However, biota directly affected by the project are a very small fraction of the marine ecosystem involved; direct and indirect effects of disposal are expected to cover a relatively confined area. Recolonization by resident species can be expected.

## 5.3 Aesthetics

As dredging operations proceed, the water column will probably appear turbid. This is likely to be most significant in North Cove. As stated before, the larger particles which cause the appearance of dirty or turbid water will settle out relatively quickly.

Nutrients dredged up will tend to increase primary productivity by phytoplankton, which in turn may change the appearance of the water. However, such changes are difficult to predict. A definite aesthetic impact from enhanced phytoplankton growth is not necessarily a probable event, although it is certainly possible.

## 6.0 Alternatives to the Proposed Action

Alternatives to the proposed maintenance dredging of the Essex Shoal and Brockway Bar in the Connecticut River Below Hartford can be categorized into three groups, relating to the method of dredged material disposal, the method of dredging, and the no-action alternative. Given the characteristics and quantities of sediments involved, the state of knowledge concerning environmental impacts of dredging, and site-specific constraints, it is believed that the project as proposed is the most feasible and at the same time environmentally acceptable of the options considered. The following sections discuss alternatives to the proposed project in greater detail.

### 6.1 Dredging

Frequency and Degree - The frequency of dredging in Essex Shoal and Brockway Bar is variable due to freshwater flow and accompanying sediment input from upland sources. Unusually severe storms accompanied by high runoff, can necessitate emergency dredging action. Because North Cove is a relatively new project which has not been maintained previously, no reliable dredging frequency has been established.

The proposed dredging will maintain Essex Shoal and Brockway Bar to authorized dimensions and North Cove to the dimensions indicated earlier. Knowledge of channel usage by commercial and recreational boating interests supports the need for the proposed project.

Method of Dredging - Maintenance dredging will be accomplished with a clamshell or bucket dredge and utilize scows for transporting material to the Cornfield Shoal disposal site in Long Island Sound. Environmentally, the clamshell dredge has certain advantages. The density of material removed by a clamshell dredge normally approaches that of the in-place sediments during dredging. Also, only a very small bottom area is disturbed at any one time by the dredge bucket. These two characteristics minimize turbidity associated with the dredging operation.

Timing of Dredging - Dredging is scheduled to be performed between September 1976 and January 1977. In any case, dredging in the Connecticut River will not be performed during the periods 1 April - 30 June and 1 October - 30 November and no dredging will be performed in North Cove from 1 April - 30 June. This is in accordance with restrictions placed on dredging in the river during other maintenance operations.

## 6.2 Disposal

Utilization of Land-Based Sites - Land-based sites for dredged material from Brockway Bar were considered during the early stages of project planning; however, no owners of potentially suitable areas were willing to permit use of their land in this purpose. In the case of Essex Shoal, material dredged recently was placed on Nott Island in the Connecticut River in conjunction with the Waterways Experiment Station's Dredged Material Research Program. Placing

additional material on this site would interfere with its ongoing development as an upland wildlife habitat area. No other suitable land-based site is available.

Land disposal sites were also considered as alternatives for disposal of North Cove material. Four specific sites were considered and were found to be inadequate for various reasons. These sites are shown on Figure 3. Site No. 1 is the present town dump for the Town of Old Saybrook. This dump is scheduled to be closed soon, and Town officials originally thought that the dredged material from North Cove would provide a good cover. The area's height, limited capacity and potential leeching problems precluded further consideration as a suitable disposal site. Site No. 2 is owned by Mr. Lombardi, a citizen of Old Saybrook, and is located adjacent to the corner of the anchorage in the cove. Mr. Lombardi was looking for some fill for approximately two acres of lowland. However, there is insufficient capacity at this site to be helpful. Site No. 3 is an area of approximately 12-15 acres located in Old Saybrook and owned by the State of Connecticut. A central portion of this area has been designated by the State as wetlands. The town has long-range plans to acquire and develop this land as a historical site. The extent of the wetlands makes this site undesirable for dredge disposal. Site No. 4 is located north of the anchorage area on land owned by Mr. Van Epps. This site consists of 10 acres of land. The construction of a dike along the east and south sides adjacent to wetlands would be a required condition for disposal at this site. Such construction would produce a containment

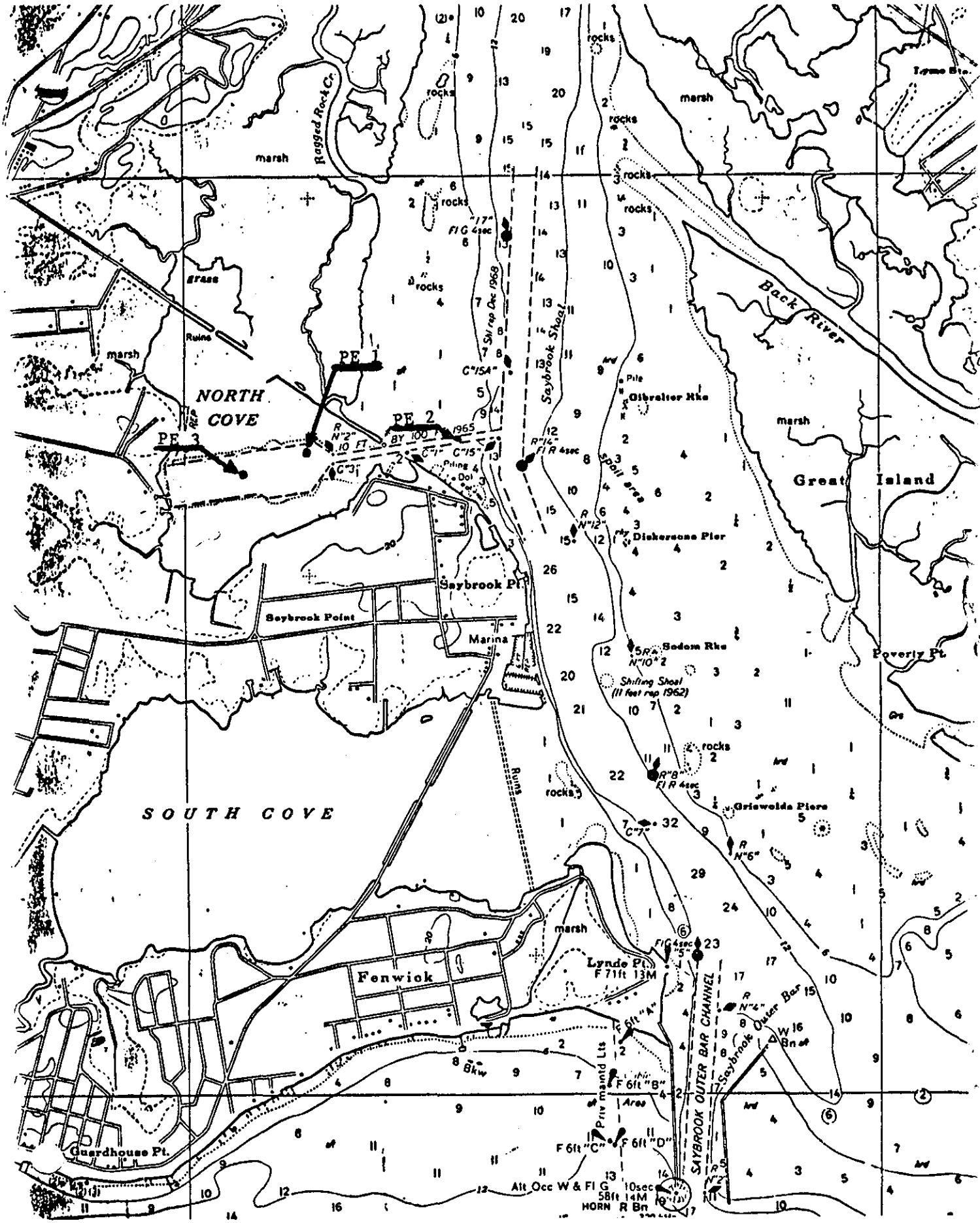

NORTH COVE
SOUTH COVE
PE 1
PE 2
PE 3
Ragged Rock Cr.
marsh
rocks
Ruins
Saybrook Shoal
Back River
Gibraltar Rks
Great Island
Saybrook Point
Saybrook Pt.
Marina
Dickerscone Pier
Sodom Rks
Poverty Pt.
Shifting Shoal
(11 feet rep 1962)
Griswolds Piers
Fenwick
Lynde Pt.
F 71ft 13M
Guardhouse Pt.
SAYBROOK OUTER BAR CHANNEL
Saybrook Outer Bar
W 16 Bn
F 6ft "A"
F 6ft "B"
F 6ft "C"
F 6ft "D"
Alt Occ W & Fl G 10sec
58ft 14M
HORN R Bn

FIGURE 2

area of insufficient capacity to hold the dredged material, precluding further consideration of this site.

Open Water Disposal - Consideration has been given to open water disposal alternatives.

Cornfield Shoal - The charted Cornfield Shoal Dumping Ground is described as an area in Long Island Sound one nautical mile square (sides running true north-south and east-west) from the center of which Saybrook Breakwater Light bears N by E (magnetic) 4,900 yards, and Cornfield Point Lightship bears W 3/8 S (magnetic) 2,875 yards, or a true bearing 179° from Saybrook Breakwater Light.

The proximity of this site to the proposed dredging and the fact that it has been used previously for disposal of material from North Cove during original dredging and from the Connecticut River during maintenance dredging resulted in its being given consideration in the proposed project.

Current measurements taken at the Cornfield Shoal disposal site by R.W. Morton and G.S. Cook (1975) indicate a strong semi-diurnal tidal influence. Current meters, approximately one meter above the bottom, were located in the northwest and southeast corners of the dumping ground. Average ebb currents were higher than average flood currents at both stations, with generally higher current velocities found at the southeast station. The highest velocity recorded was approximately 2.5 fps at the southeast station. Average current velocities at the southeast station were 2.1 fps (ebb) and 1.8 fps (flood). At the northwest station, average ebb and flood velocities were 1.6 fps and 1.2 fps respectively.

Progressive vector plots of the current readings revealed a net northwesterly drift at the southeast station and a net westerly drift at the northwest meter. Mean velocity (ebb-flood) for the southeast station is 0.37 fps (319°) and 0.32 fps (285°) for the northwest station.

Based upon the above, and the fact that sediments at the Cornfield Shoal site are primarily composed of gravel and course sands (MACFC Informal Report No. 42, 1974), it appears that this is a dispersal site with Long Sand Shoal acting to modify the strength and direction of dispersal.

The general area in which the Cornfield Shoal site is located is assumed to be inhabited by nearly all of the approximately 100 finfish species known to inhabit Long Island Sound. Commercially important finfish in the area include shad, menhaden, alewife, scaup and flounder. The lobster yield and the intensity of fishing are not available.

Cornfield Shoal has been used previously as a disposal site for clean granular materials totalling slightly more than 1,008,000 cubic yards. No adverse comments have been received as a result of previous disposal operations, and there is no reason to believe that the proposed disposal will have any significant impact upon environment.

New Haven Disposal Site - This site was also considered as an alternative for disposal. This site covers an area two nautical miles long and one nautical mile wide. From the center of the site,

Southwest Ledge Light bears True 345°, distance 10,750 yards, and Townsend Ledge Lighted Gong Buoy 10A bears True 013°, distance 7,400 yards. Depths range from 63 to 72 feet (19 to 22 meters) at mean low water. The New Haven Dumping Ground is approximately 28 nautical miles from the entrance of North Cove.

Studies conducted in conjunction with previous disposal operations have demonstrated that the New Haven Dumping Ground is a containment site. Inasmuch as containment of the material to be disposed of is among the objectives of the proposed project, this appears to be a suitable site from that standpoint. Further, there are no indications that disposal of approximately 900,000 cubic yards of material from New Haven Harbor in 1973 - 4 has resulted in any significant environmental losses. There is no reason, with the information at hand, that the New Haven Dumping Ground could not serve the proposed maintenance dredging project from an environmental point of view. However, the distance of this site from the area to be dredged does present a substantial economic disadvantage for the proposed work and for any future work in the vicinity of the Connecticut River. Given the limits of knowledge concerning the environmental effects of dredged material disposal, our present thinking favors establishment of regional dumping grounds within economic haul distances from areas of concentrated dredging activity.

New London Dumping Grounds - This area is described as one nautical mile square (sides running true north-south and east-west) from the center of which Orient Point Light bears S by E 1/w E (magnetic)

3,350 yards, and Plum Island Light bears SE (magnetic) 3,200 yards; depths range from 63 to 72 feet.

Based on information gained from monitoring at the Navy's disposal operations at the New London Dumping Grounds, it is considered that this is an environmentally acceptable alternative disposal area for the proposed work. However, it is not located so as to serve as a viable disposal area for the region around the Connecticut River estuary. In addition, there is at present a court injunction against present use of the New London Dumping Grounds, eliminating it from further consideration for the proposed disposal operations.

Niantic Dumping Grounds - This site occupies an area one nautical mile square (sides running true north-south and east-west) from the center of which Bartlett Reef Lighted Whistle Buoy 2A bears ESE (magnetic) 4,050 yards, and Bartlett Reef Light bears E (magnetic) 4,300 yards. Depths range from 66 to 94 feet at mean low water.

Sediments at this site consist primarily of sand, with some gravel and clay (Gordon, 1973). NOS charts indicate maximum ebb current velocity of 1.8 knots and a mxaimum flood current velocity of 1.9 knots. It appears from available data that this is a dispersal site with a net landward transport. It has in the past been used for disposal of approximately 176,000 cubic yards of material, consisting of medium sand, with no known adverse effects noted. The site does not appear to be suitable for long range use in disposing of other than clean granular materials and consequently is not favored for use in the proposed project. Some commercial fishing is conducted in the area of the Niantic site, with

scup being the principal species caught. There are shellfish resources in the Niantic area, and lobstering is done at the dump site. No information is available as to the yield or value of the catch in either case.

Clinton Dumping Grounds - This is an area of one nautical mile square (sides running true north-south and east-west) from the center of which Kelsey Point Breakwater Light bears NNE 1/2 E (magnetic) 3,050 yards and Long Sand Shoal West End Lighted Bell Buoy bears E 3/8 S (magnetic) 5,400 yards. Depths range from 79 to 114 feet at mean low water.

No specific information is available on this site; thus there is little basis for making a case either for or against its use in the proposed project. It is known that the Connecticut Department of Environmental Protection has reservations concerning using this site (letter dated 15 April 1976 from Commissioner Gill). In addition, the site is not so located as to serve as a long-term regional disposal site.

## 6.3 No Action

The Essex Shoal and Brockway Bar channels have shoaled to the point where maintenance is necessary. The work should proceed without undue delay so that the river's value to commercial navigation is not interrupted or diminished. If no action were taken, not only environmental impacts but also beneficial socioeconomic impacts would be foregone. The existing shoals serve to increase the cost

of shipping in the river due to light loading; they also could result in groundings or collisions, thereby increasing the potential for a significant oil spill. Obviously, there are trade-offs involved in balancing these effects. It is believed that the provision of safe and adequate channel dimensions for those who depend on them necessitates the proposed maintenance dredging action.

Selection of the "No Action" alternative was also considered in relation to the long-range implications to the total human environment of the Old Saybrook area. As reviewed in previous sections of this report, Old Saybrook is a historical and recreational resource for the State of Connecticut. Much of the recreational activity is related to the aquatic environment, specifically to boating and yachting. Progressive shoaling in the anchorage and channel areas of North Cove is unfavorable to the full utilization of the recreational potential of the area and threatens the continued availability of one of the few protected anchorage areas in the vicinity. Potential negative effects of the no action alternative include decrease in recreational boating, possible casualties to recreational vessels, and probable decrease in the marine and related industries in the immediate area.

## 7.0 RELATIONSHIPS BETWEEN SHORT-TERM AND LONG-TERM GAINS AND LOSSES

Short-term losses of biota in the relevant aquatic ecosystems, as well as long-term utilization of water resources will result from the proposed project.

Short-term disruptions and losses of biota have been discussed in this report. Living systems can establish new dynamic equilibria and resume productivity after disruptions by natural or man-made events. It is improbable that the actions proposed in this project will cause long-term disruptions in aquatic productivity.

A long-term gain from the proposed project is maintenance of recreational and cultural resources of the Old Saybrook area. Periodic but infrequent maintenance dredging of the anchorages and entrance channel will be required as long as boating usage remains at the present level. This is not expected to effect any long-term disruption of the Old Saybrook area because of major land use changes. The area is recognized as one of cultural, historical, and recreational importance, and it is likely that these resources will be preserved.

Navigational maintenance of the 15' channel in the Connecticut River is necessary to insure the safe and unobstructed passage of oil barges. This oil supplies the energy needs of industry and and homeowners alike and is essential to the socio-economic stability of the area. Because of the nature of the dredged material (sand) and scheduling of the maintenance operation, serious effects to the

indigenous river biota or to migrating species such as the shad are not expected. The assumption made is that the economic benefits resulting from the channel maintenance outweigh any possible adverse effects. Maintenance of navigation in the river is thus viewed as a long-term gain in economic productivity.

## 8.0 ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

Implementation of the proposed project will result in the irretrievable commitments of capital, energy and labor.

Although losses of some benthic organisms during dredging and disposal are irretrievable, the effects on the ecosystem are not irreversible; repopulation and recolonization of disturbed areas is known to begin shortly after cessation of the disturbance. Effects on the ecology of the open water disposal site probably represent the longest-lasting impacts discussed in this assessment. However, as in the case of impacts at the dredging sites, recolonization is anticipated.

TABLE 3

SUMMARY OF POTENTIAL IMPACTS

| Time Frame of Impact and Phase of Project | Physical/Chemical Impacts | Biological and Ecological Impacts | Other Environmental Impacts |
|---|---|---|---|
| SHORT TERM<br><br>Dredging Operations | .Alternation and Removal of Benthic Substrate<br>.Release and Temporary Suspension of Dredged Material in Water Column<br>.Temporary Release of Nutrients<br>.Temporary Release of Potentially Toxic Materials<br>.Temporary Decrease in Light Penetration<br>.Temporary Loss in Water Quality | .Loss of existing Benthic Communities in Dredge Area<br>.Potential Temporary Reduction in Photosynthesis<br>.Potential Temporary Increase in Primary Productivity<br>.Potential Toxic Effects on Biota | .Temporary Reduction in Visual Aesthetic Value of Water Column |
| Disposal Operations | .Temporary Increase in Turbidity at Disposal Site<br>.Increase of Sediment at Disposal Site<br>.Temporary Decrease in Water Quality<br>.Temporary Introduction of Potentially Toxic Materials in Sediment and Water Column | Burial and Disruption of Benthic Biota<br>.Temporary Disruption of Respiratory Mechanisms<br>Temporary Reduction in Photosynthesis | .Temporary Reduction in Visual Aesthetic Value of Water Column<br>.Temporary, Localized Disruption of Commercial Fishing Near the Disposal Site<br><br>(Cont. on Next Page) |

TABLE 3 (Continued)

SUMMARY OF POTENTIAL IMPACTS

| Time Frame of Impact and Phase of Project | Physical/Chemical Impacts | Biological and Ecological Impacts | Other Environmental Impacts |
|---|---|---|---|
| SHORT TERM<br><br>Disposal Operations (Cont.) | .Temporary Reduction in Light Penetration | .Toxic Effects on Biota | |
| LONG TERM | | .Increase in Biological Productivity in North Cove | .Continued Use of North Cove for Recreational Boating<br>.Avoids Need for Future Relocation of Recreational Boats<br>.Revenues from Moorings Will be Maintained<br>.Maintains Navigation of Conn. River With Advantages of Waterborne Transport<br>.Maintains Cultural and Aesthetic Resources of the Area |

# 9.0 COORDINATION

The proposed project and specific aspects thereof have been discussed with numerous public agencies, private organizations, and individuals. Many of these groups or individuals offered written reports, letters, and oral communications. A list of the contacts appears in Appendix A.

The proposed project has been the subject of extensive coordination with Federal, State and local agencies. Specifically, written and oral communication has been conducted with the United States Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Connecticut Department of Environmental Protection and the Old Saybrook Waterfront Advisory Commission. Particular effort has been directed toward obtaining information and comments from these agencies regarding the availability and suitability of alternative disposal sites and methods for North Cove, Brockway Bar and Essex Shoal. Consideration of all available options has resulted in the conclusion that point disposal at the site which has been identified in this Assessment is the only viable alternative.

(1) Advisory Waterfront Commission
Old Saybrook, Connecticut

(2) Chamber of Commerce
Old Saybrook, Connecticut

(3) Connecticut Department of Agriculture
Aquaculture Division
Milford, Connecticut

(4) Connecticut Department of Commerce
Hartford, Connecticut

(5) Connecticut Department of Environmental Protection
(Conn. DEP)
Hartford, Connecticut

(6) Connecticut River Estuary Regional Planning Agency
Essex, Connecticut

(7) Connecticut Shellfish Commission
Hartford, Connecticut

(8) Connecticut State Department of Health
Hartford, Connecticut

(9) National Marine Fisheries Service
Biological Laboratory
Milford, Connecticut

(10) National Marine Fisheries Service
Middle Atlantic Coastal Fisheries Center
Sandy Hook Laboratories
Highlands, New Jersey

(11) Naval Underwater Systems Center
New London Laboratory
New London, Connecticut

(12) New England River Basins Commission (NERBC)
Boston, Massachusetts

(13) New England River Basins Commission (NERBC)
Long Island Regional Study
New Haven, Connecticut

(14) Selectwoman Barbara Maynard
Old Saybrook, Connecticut

(15) University of Connecticut
Marine Sciences Institute
Avery Point, Connecticut

(16) University of Connecticut
Marine Laboratory
Noank, Connecticut

(17) U.S. Department of Agriculture
Soil Conservation Service
Extension Center
Haddam, Connecticut

(18) U.S. Environmental Protection Agency (USEPA)
Region I
Boston, Massachusetts

(19) Yale University
Dept. of Geology and Geophysics
New Haven, Connecticut

## CONCLUSIONS

Based on my review of the information within the project's assessment and in consideration of the general public need, I believe the project as described should proceed according to schedule. In my evaluation the assessment prepared in accordance with the National Environmental Policy Act of 1969 is an accurate document revealing that the negative environmental impacts associated with the project are minor. The assessment, therefore, precludes the need for preparation of an environmental impact statement.

4 May 1976
DATE

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

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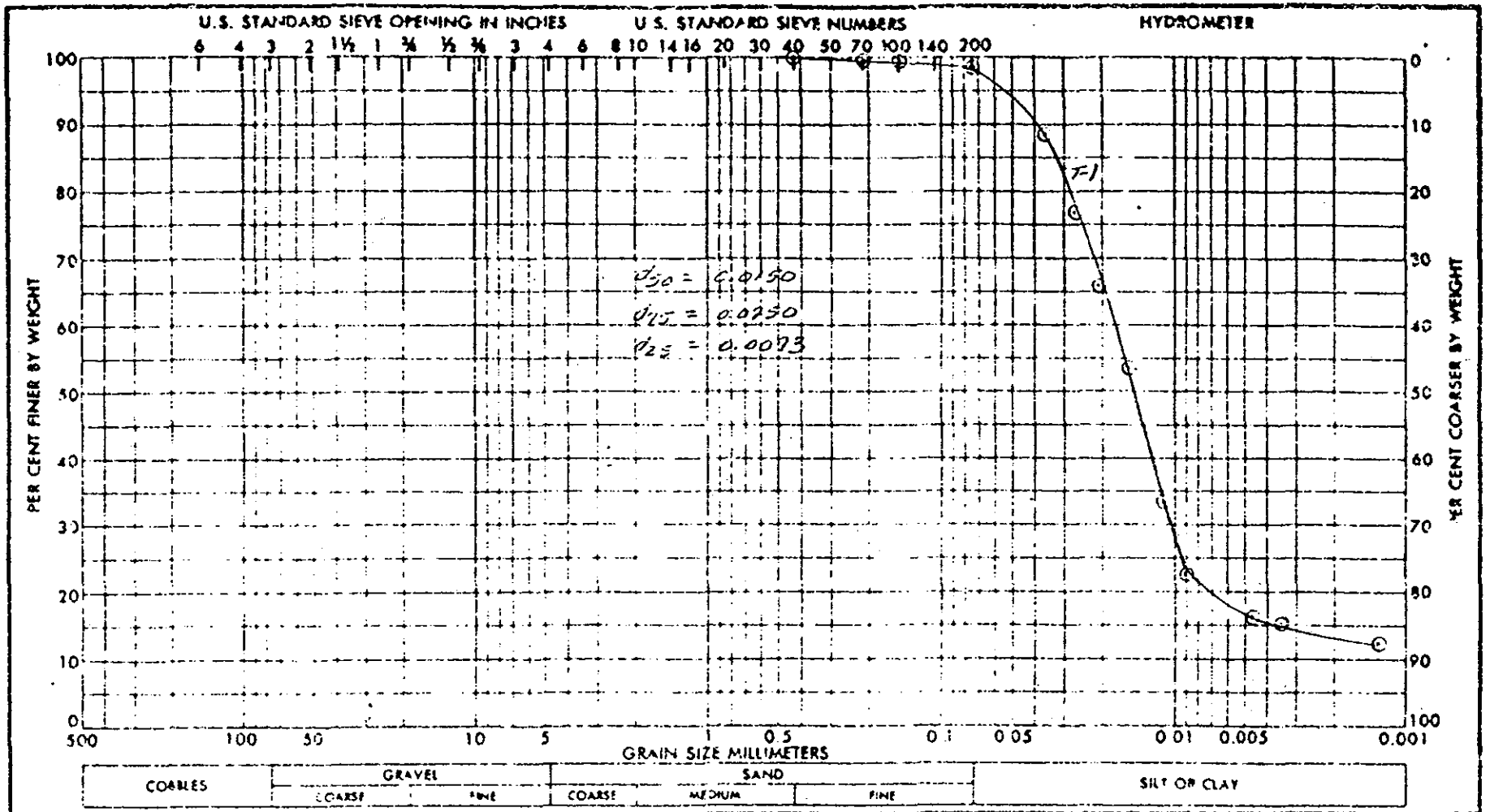
# APPENDIX A

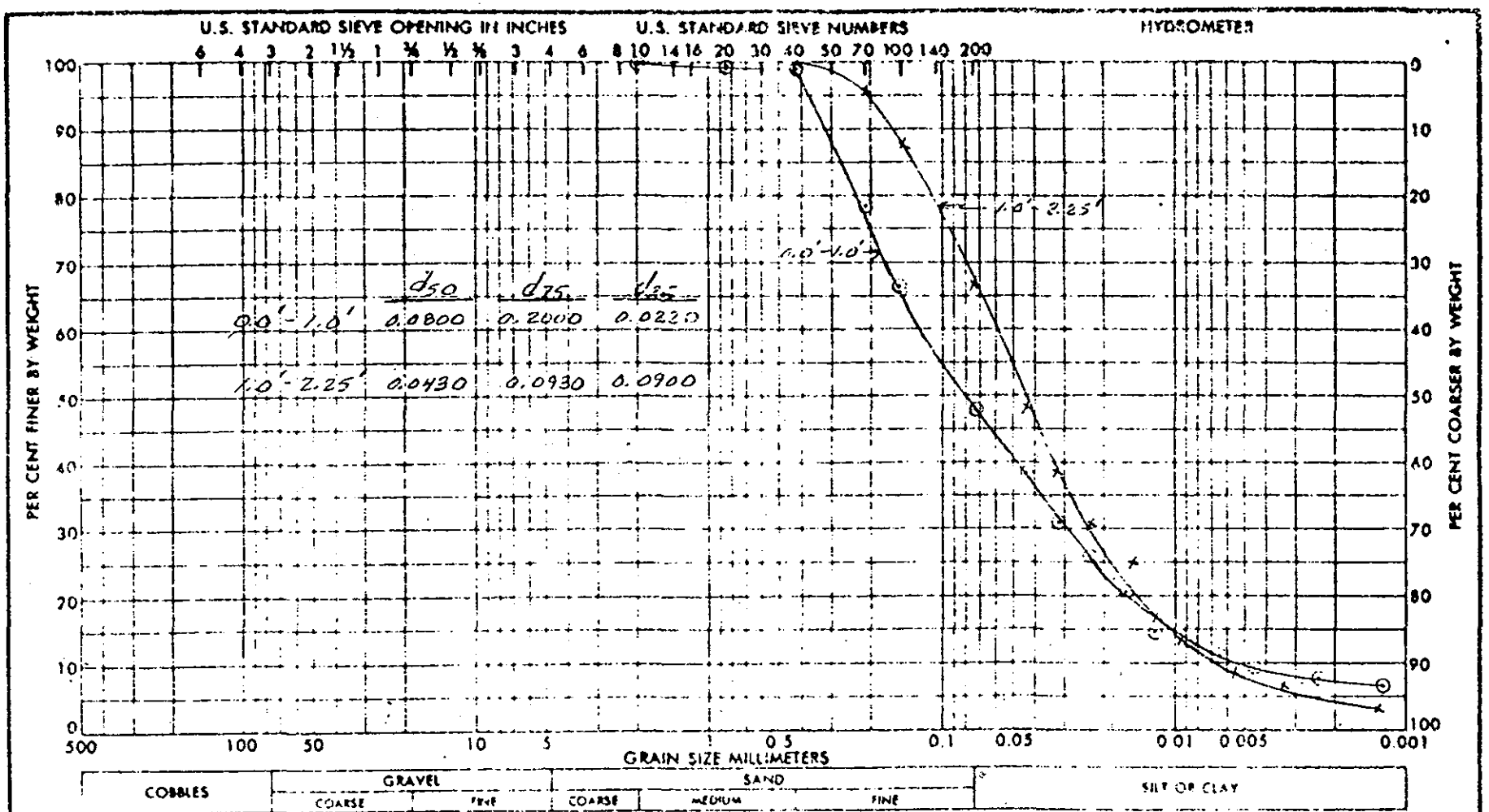



| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| T-1 | 0.0'-1.95' | Organic SILT (OH) | * | 84 | 46 | 38 |
| | | | ** | 62 | 45 | 17 |

* Test run on natural soil
** Test run on oven dried soil

GRADATION CURVES

PROJECT North Cove
Old Saybrook, Conn.
AREA
BORING NO PE-1
DATE January 1975

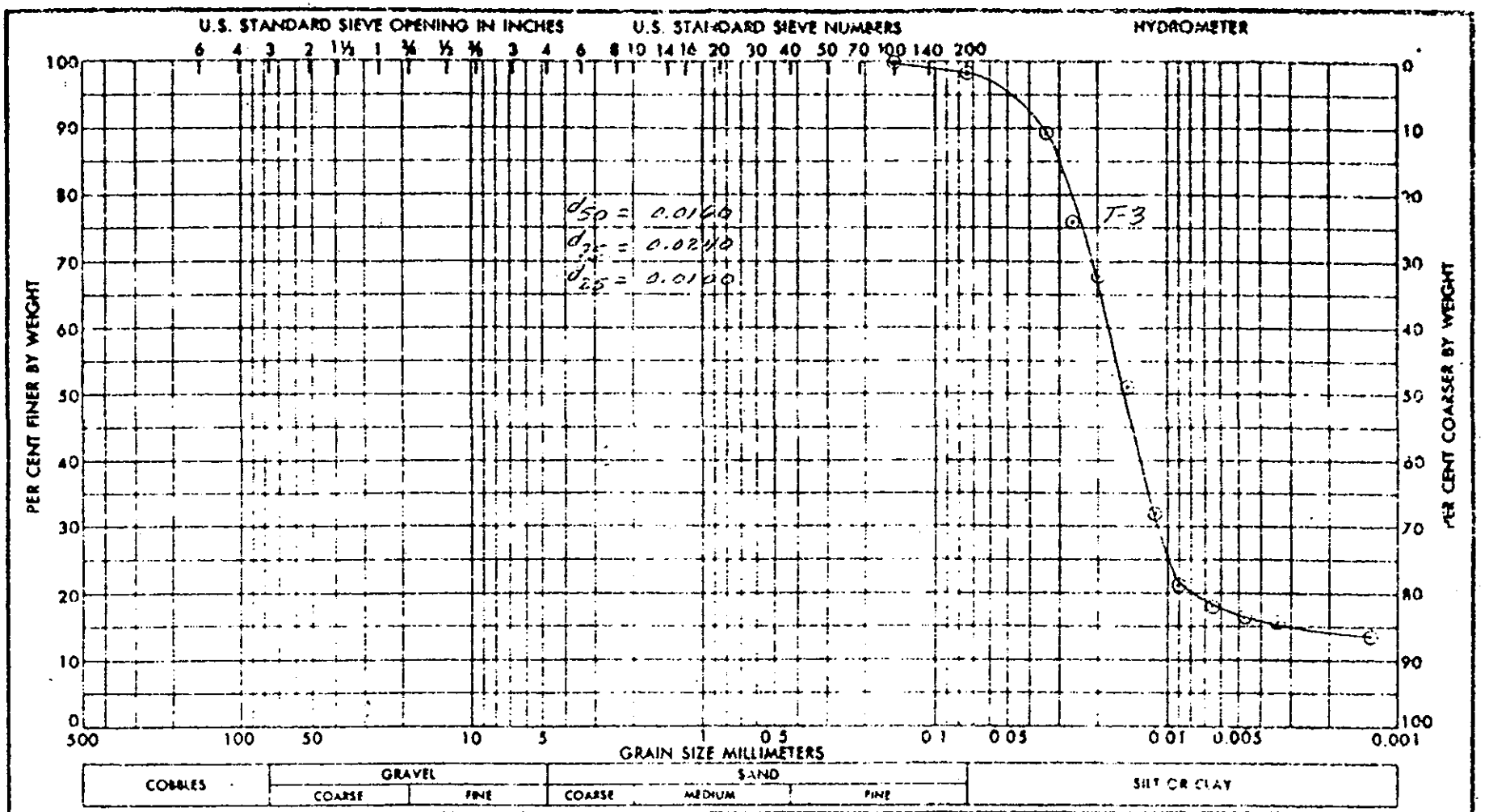



| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| T-3 | 0.0'-1.0' | Organic silt, little fine sand (OL) | | 39 | 28 | 11 |
| T-3 | 1.0'-2.25' | Fine sandy Organic SILT (OL) | | 42 | 31 | 11 |

GRADATION CURVES

PROJECT North Cove
Old Saybrook, Conn.
AREA
BORING NO PE-2
DATE January 1975

ENG FORM 2087 REPLACES WES FORM NO. 1241, SEP 1962 WHICH IS OBSOLETE.

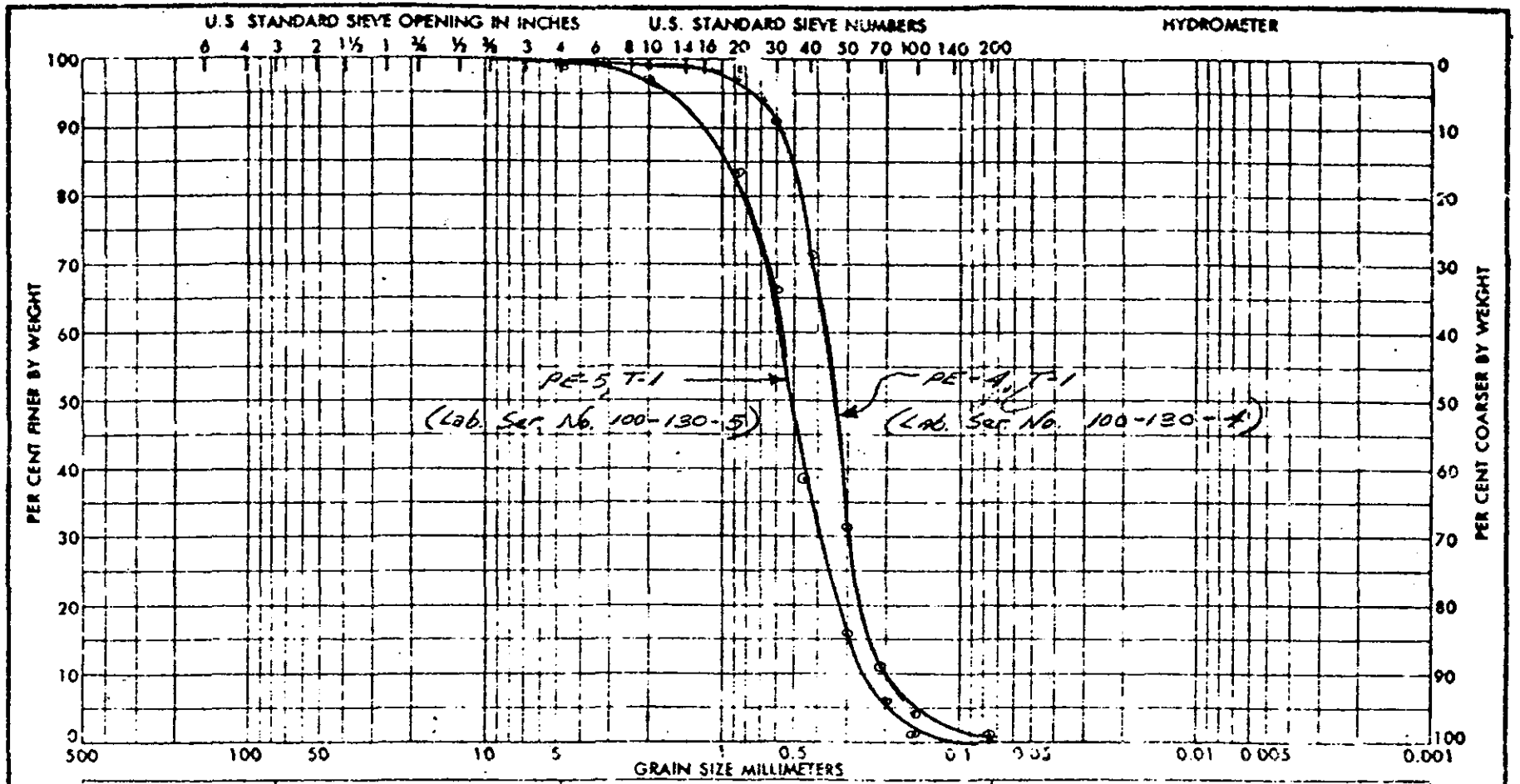



| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| T-3 | 0.0'- 3.2' | Organic Silt (CH) | | 83 | 45 | 38 |

GRADATION CURVES

PROJECT North Cove
OIJ Saybrook, Conn.
AREA
BORING NO PE-3
DATE January 1975

ENG FORM 2087 REPLACES WES FORM NO 1241, SEP 1962, WHICH IS OBSOLETE




| SAMPLE NO | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PI | P |
|---|---|---|---|---|---|---|
| PE-4, T-1 | 0.0'-1.0' | med-fine SAND (SP) | | | | |
| PE-5, T-1 | 0.0'-1.6' | fine to med SAND (SP) | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

GRADATION CURVES

PROJECT Connecticut River
below Hartford
AREA Essex Shoal
BORING NO PE-4 & PE-5
DATE March 1974

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE.

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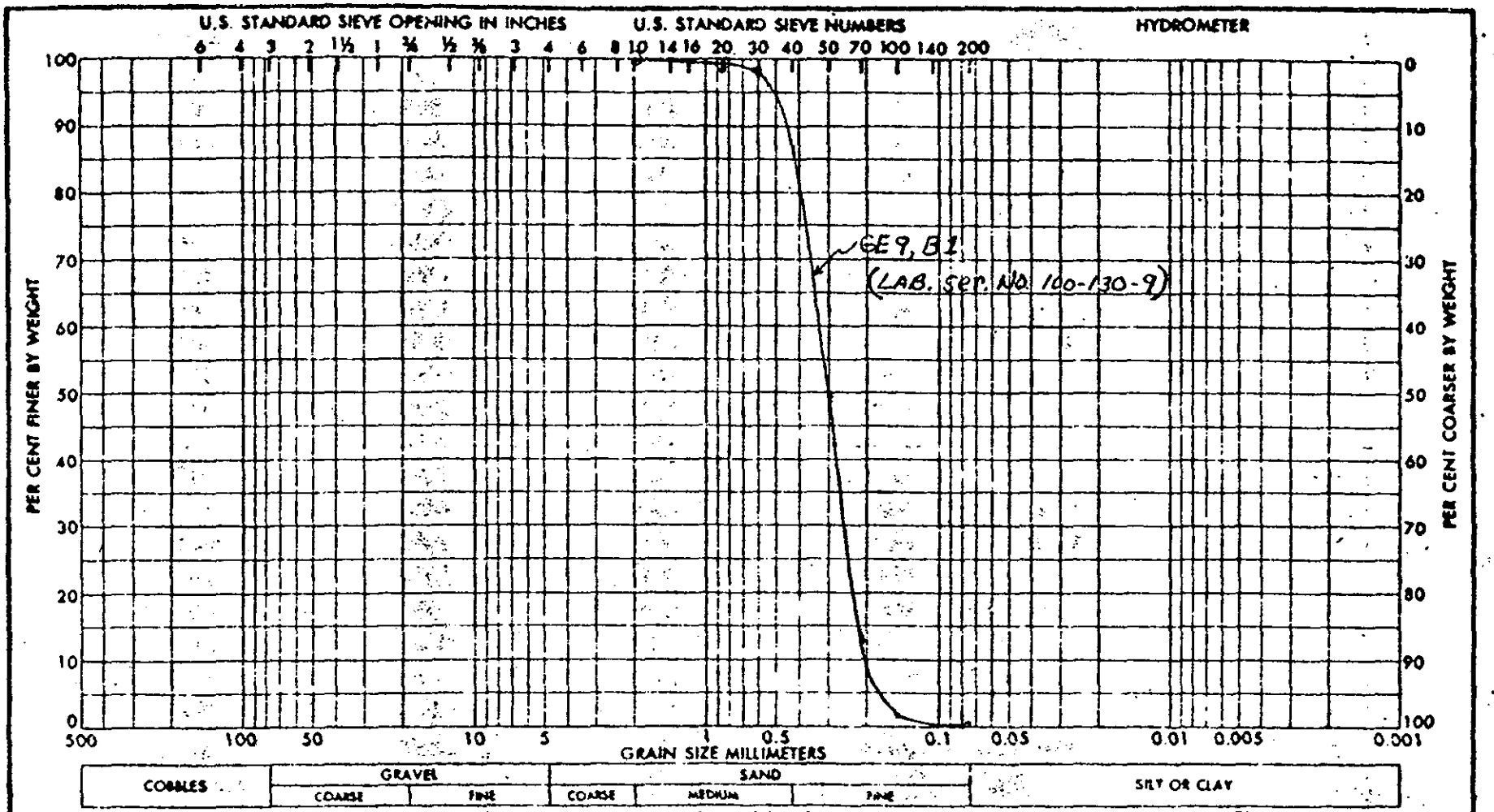



| SAMPLE NO. | ELEV OR DEPTH | CLASSIFICATION | NAT W% | LL | PL | PI |
|---|---|---|---|---|---|---|
| GE9, B1 | Surface | fine SAND (SP) | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

GRADATION CURVES

PROJECT Connecticut River below Hartford
AREA Brockaway Bar
BORING NO. GE9
DATE March 1974

ENG FORM 2087 REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE.
1 MAY 63

U.S. GOVERNMENT PRINTING OFFICE

ATTACHMENT 3

# DAMOS

# DISPOSAL AREA MONITORING SYSTEM

# ANNUAL DATA REPORT - 1978

## SUPPLEMENT G

## CORNFIELD SHOALS DISPOSAL SITE

## Naval Underwater Systems Center

## Newport, Rhode Island


New England Division
Corps of Engineers
Waltham, Massachusetts

May 1979

DAMOS

# DISPOSAL AREA MONITORING SYSTEM
# ANNUAL DATA REPORT - 1978

## SUPPLEMENT G
## SITE REPORT - CORNFIELD SHOALS

Naval Underwater Systems Center
Newport, Rhode Island

New England Division
Corps of Engineers
Waltham, Massachusetts

May 1979

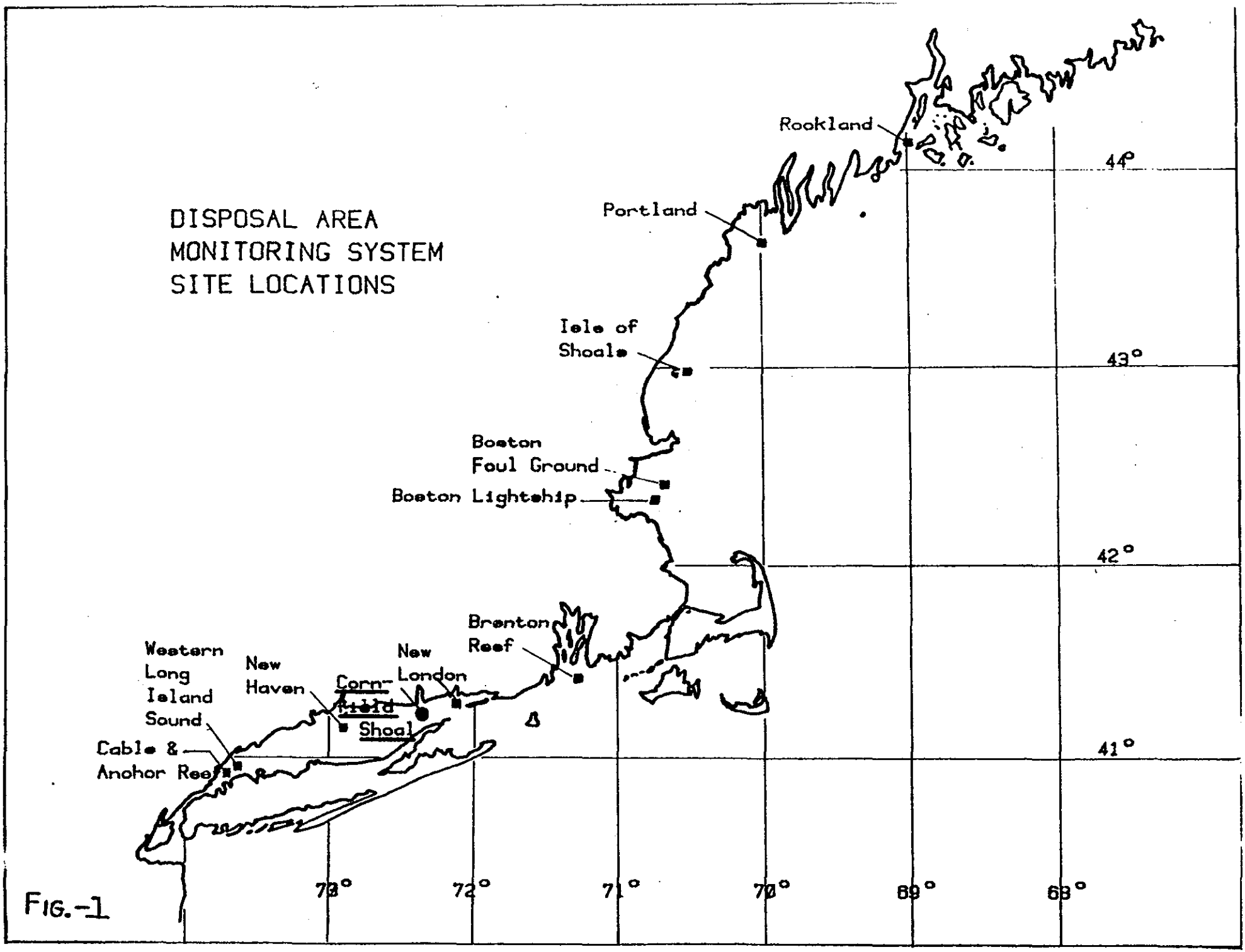

DISPOSAL AREA
MONITORING SYSTEM
SITE LOCATIONS
Rookland
Portland
Isle of
Shoals
Boston
Foul Ground
Boston Lightship
Brenton
Reef
New
London
New
Haven
Corn-
field
Shoal
Western
Long
Island
Sound
Cable &
Anchor Reef
44°
43°
42°
41°
73°
72°
71°
70°
69°
68°

FIG.-1

DISPOSAL AREA MONITORING SYSTEM

This is one of a series of site specific data reports resulting from the DAMOS program, now two years in progress. DAMOS is the culmination of nearly a decade of prior study efforts, actually preceding NEPA, which have been directed towards the understanding of the effects of and the responsible management of the ocean disposal of dredged materials in New England waters as they fall under the authority of the New England Division of the Corps of Engineers. The individual site reports henceforth will be updated approximately on an annual bases as additional knowledge is gained, at least with respect to those sites where significant disposal activities will have occurred.

## CORNFIELD SHOALS

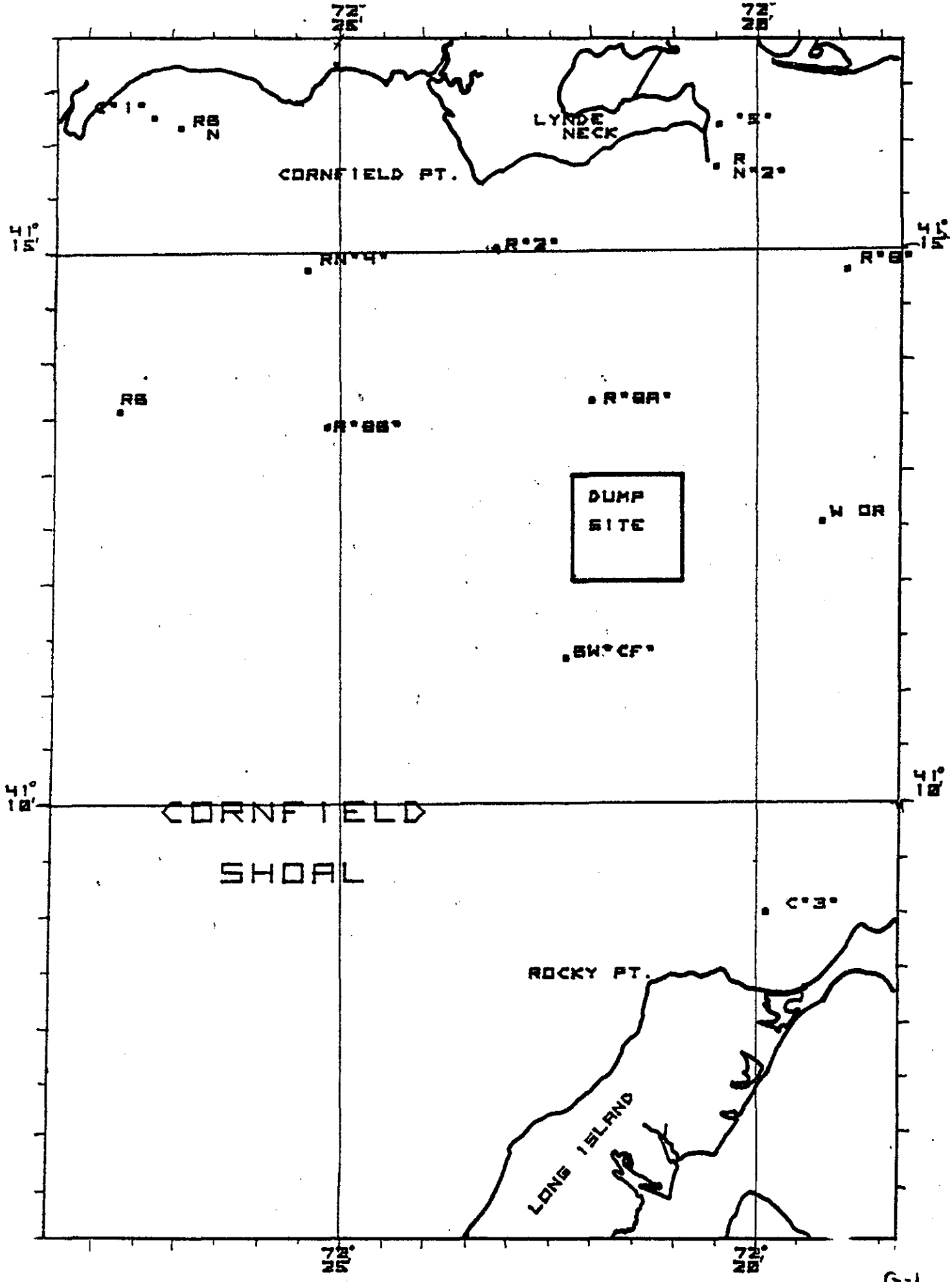
The Cornfield Shoals disposal site (Fig. G-1) is located 6.5 km south southwest of the entrance to the Connecticut River, approximately in the middle of Long Island Sound. This site has been used in recent months for the disposal of spoils from the North Cove project in Old Saybrook, Conn. Sediments in the area are generally clean sands with some gravel present in isolated areas.

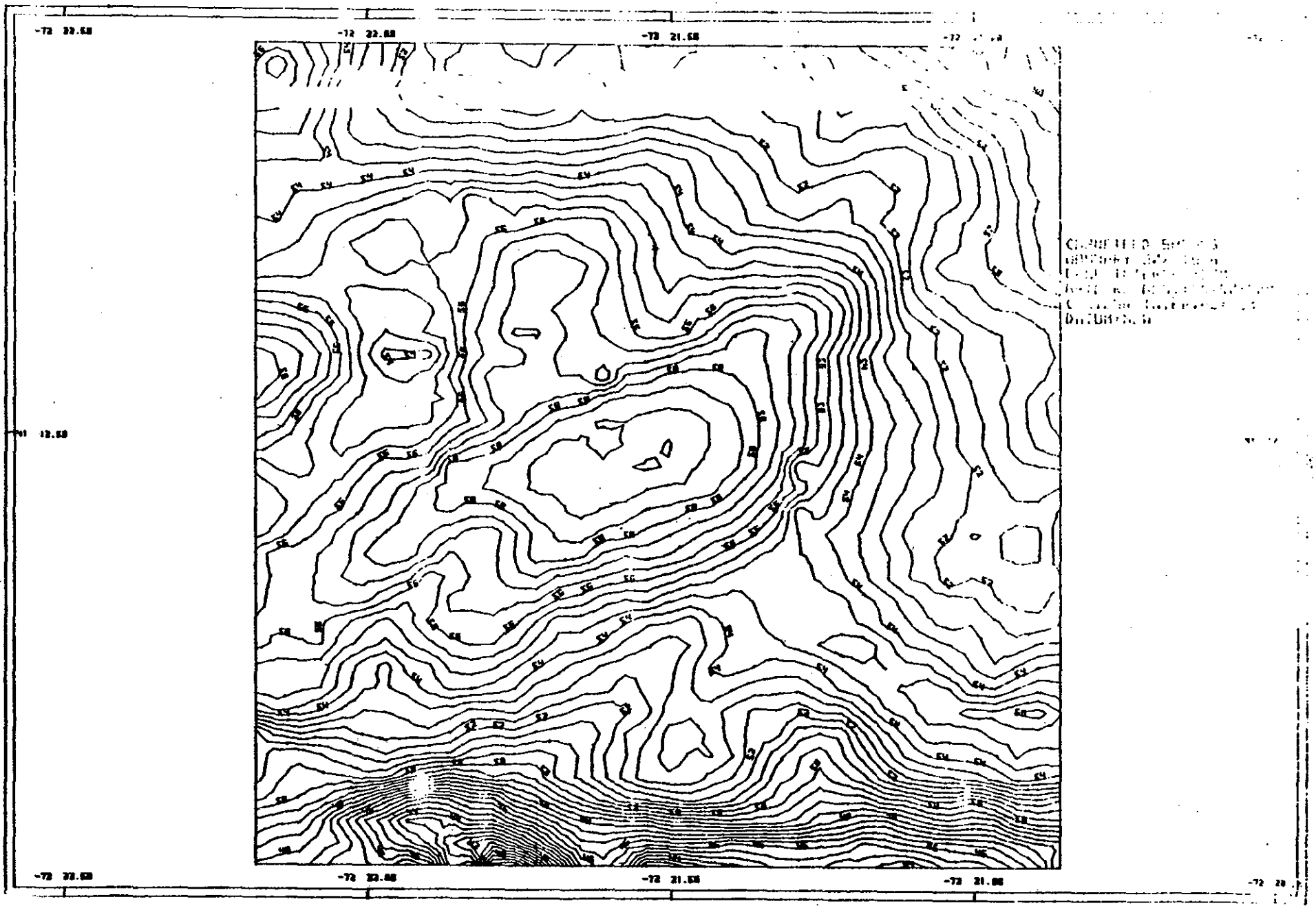
### Bathymetry

Navigation control for operations at the Cornfield Shoals site is provided by trisponder stations installed at the Old Saybrook Lighthouse at the entrance to the Connecticut River and at the Lyme Point Lighthouse farther west. Two surveys have been made at the Cornfield Shoals site; the first on January 30, 1978, (Figure G-2(a-k)) and the second on July 30, 1978 (Figure G-3(a-k)). Both of these surveys depict the disposal site as a gentle depression in the center of the site, with a relatively steep slope to a shoal area on the southern margin.

There is, however, a 1.5 meter discrepancy between these two surveys such that the July survey is more shallow. This is a constant offset in the data, since all contours and profile plots have essentially the same features and the offset is the same for all profiles negating a mistake in the tidal corrections. It appears that a draft correction was probably not applied to the July survey, however, this cannot be confirmed until another survey has been completed.

In spite of the correction problem the bathymetric data at Cornfield Shoals is incapable of defining the presence of a spoil mound at this site. Although point dumping was used at this site, the spoils have not formed a distinctive topographic feature on the bottom. Furthermore, side scan sonar surveys in this area have failed to detect any change in the bottom indicative of spoil material.


72° 25'
72° 28'
41° 15'
41° 18'
"1"
RB N
CORNFIELD PT.
LYNDE NECK
"5"
R N"2"
R"2"
RN"4"
R"6"
RB
R"8A"
R"8B"
DUMP SITE
W OR
SW"CF"
CORNFIELD SHOAL
C"3"
ROCKY PT.
LONG ISLAND


-72 22.50
-72 22.50
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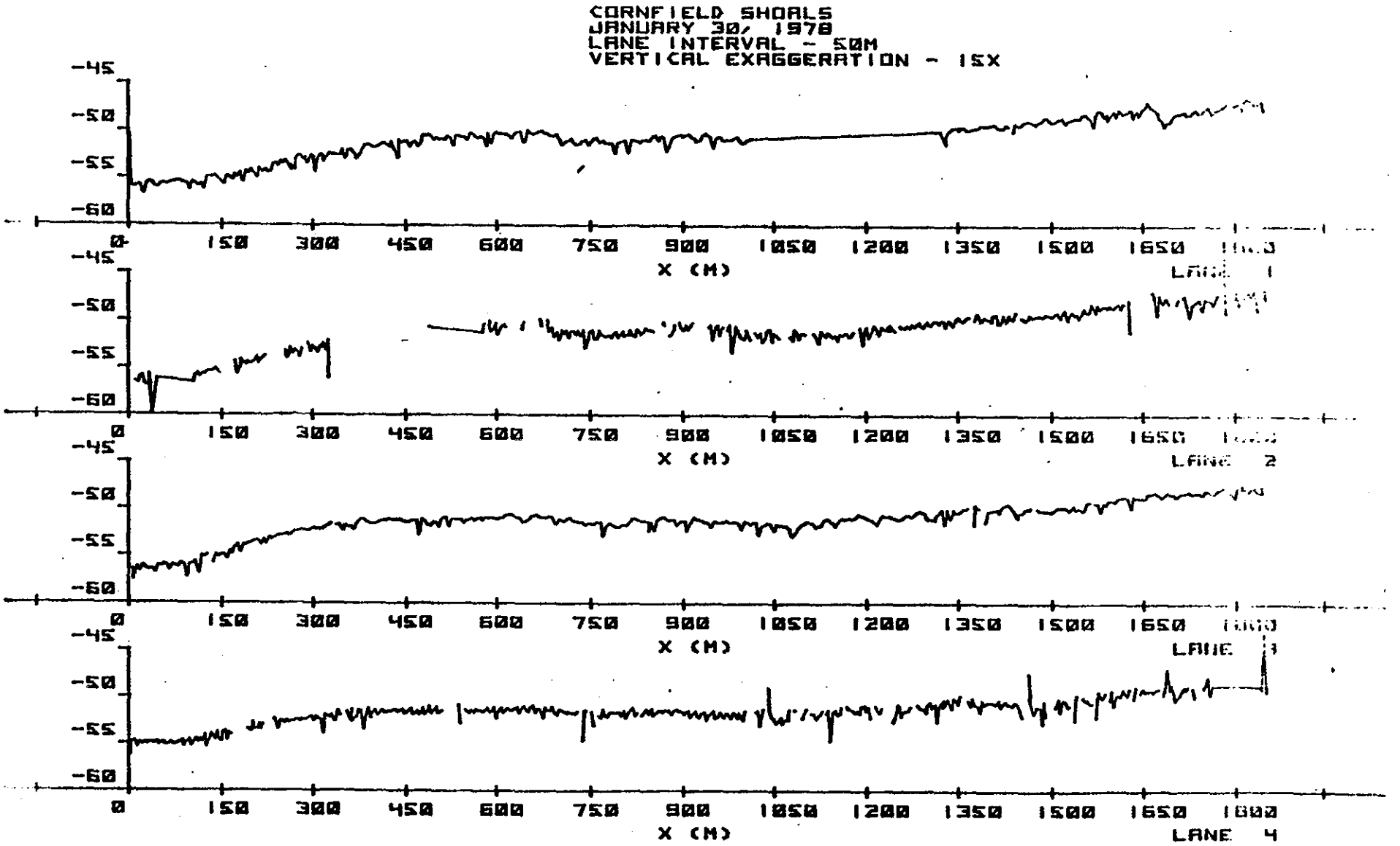
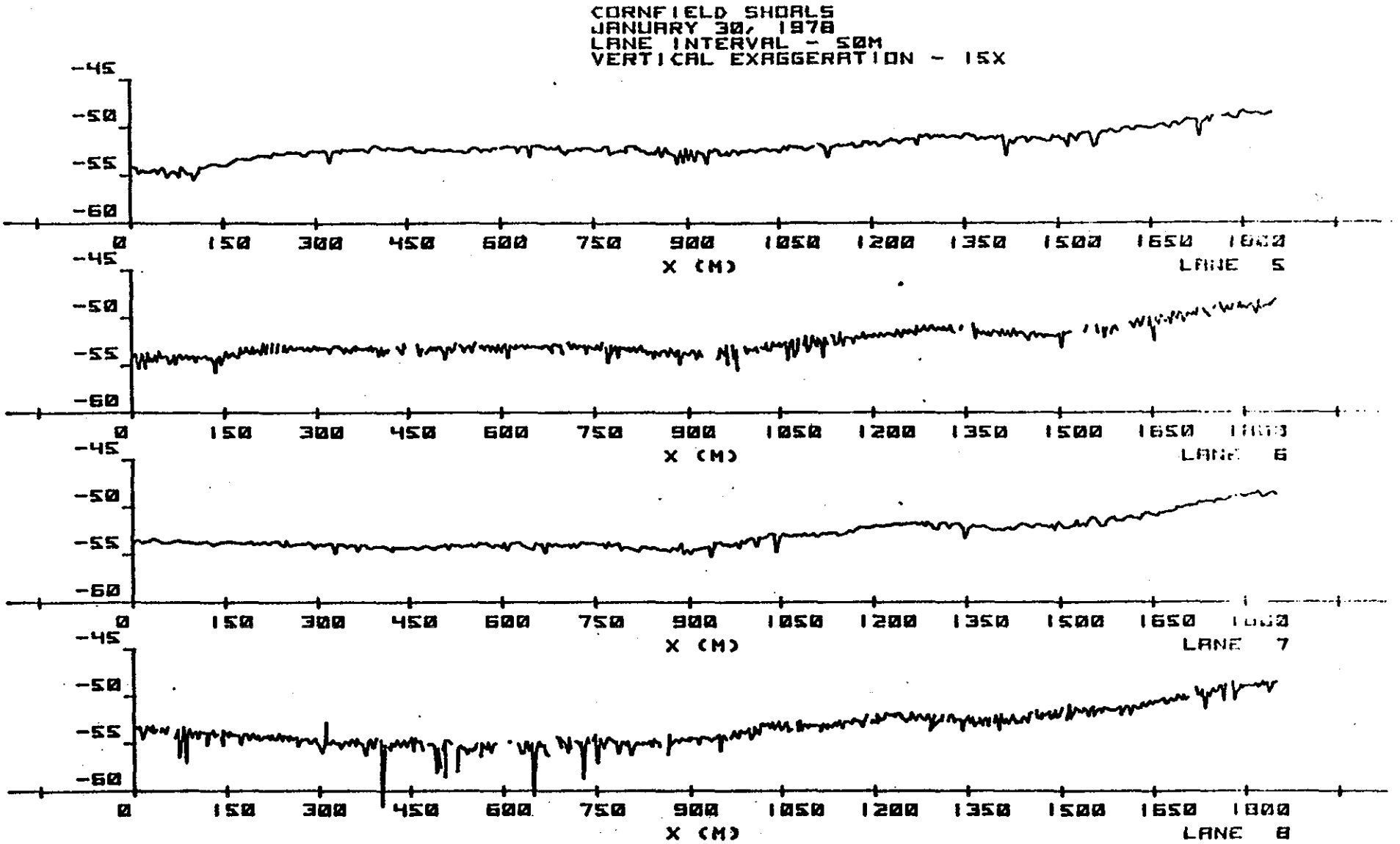
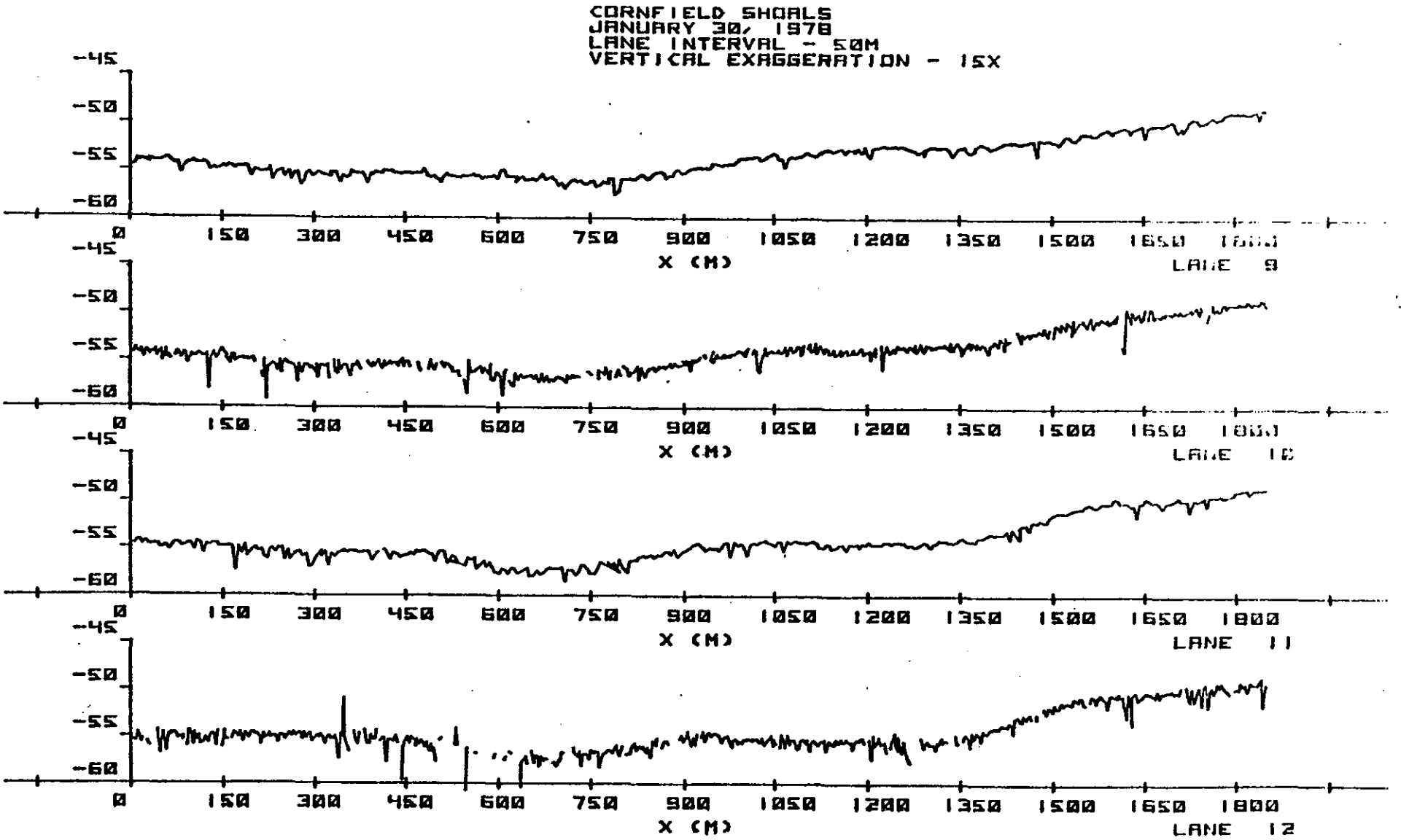
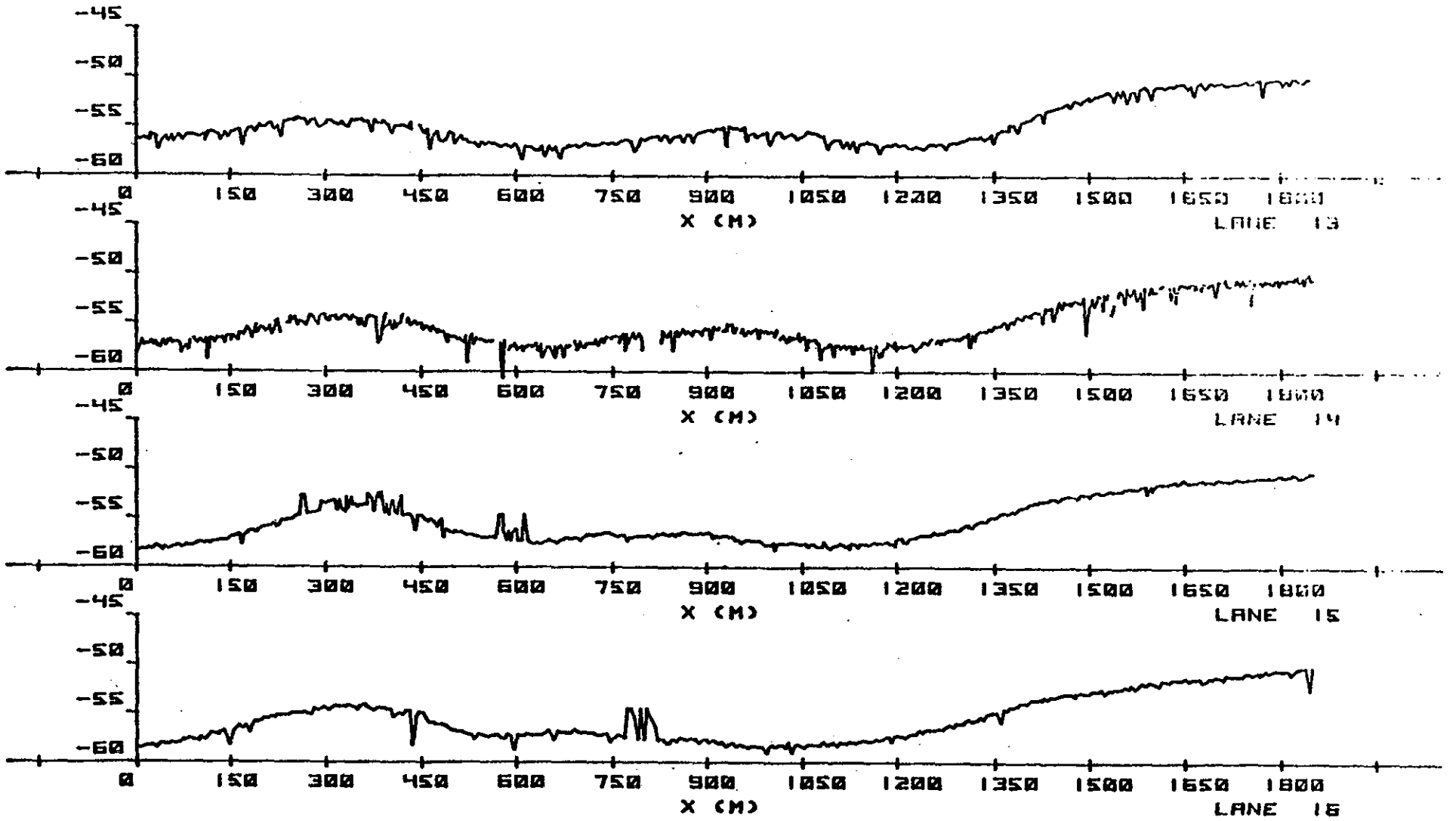
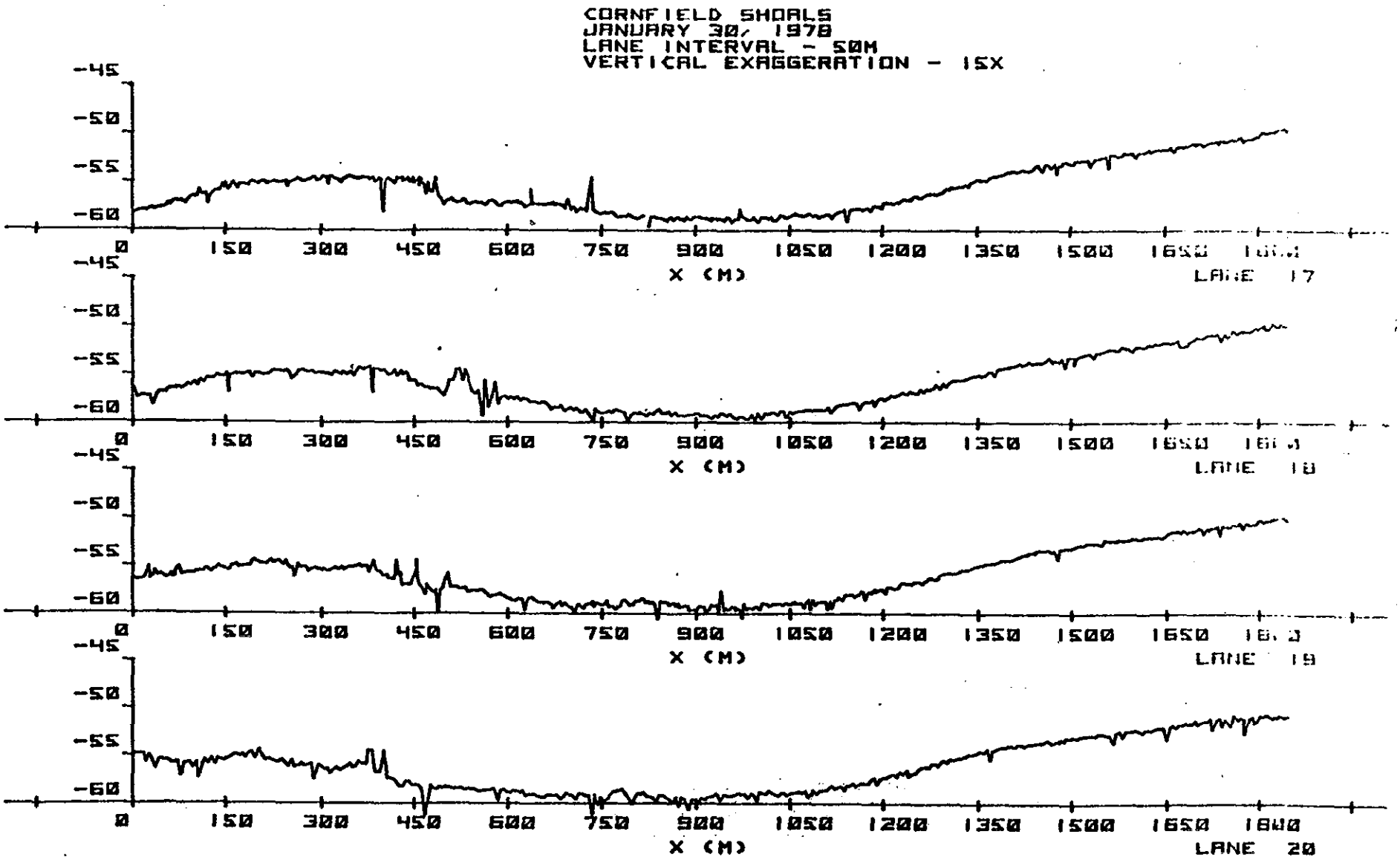
-72 21.00

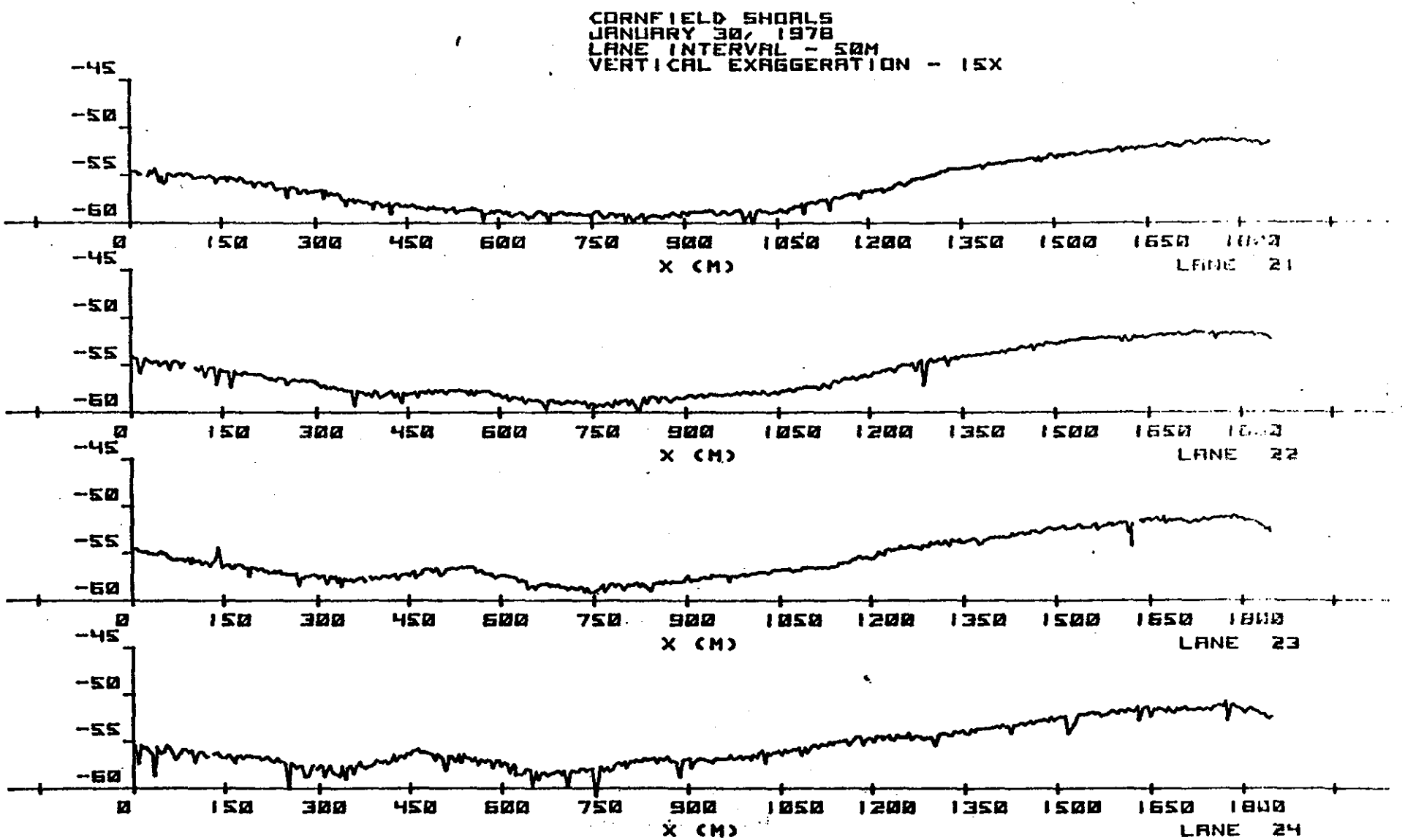

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
X (M)
LANE 1
LANE 2
LANE 4

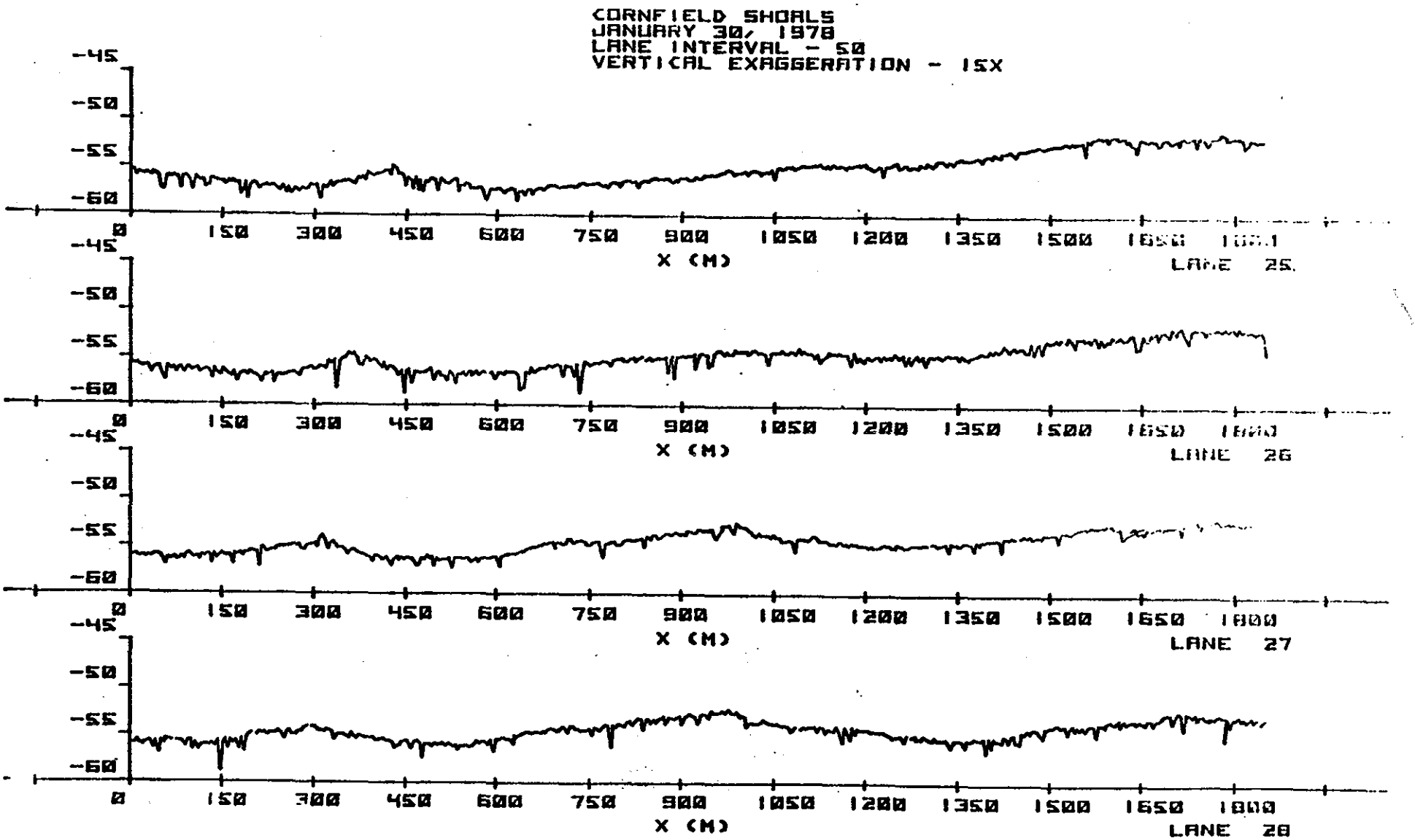

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
X (M)
LANE 5
LANE 6
LANE 7
LANE 8

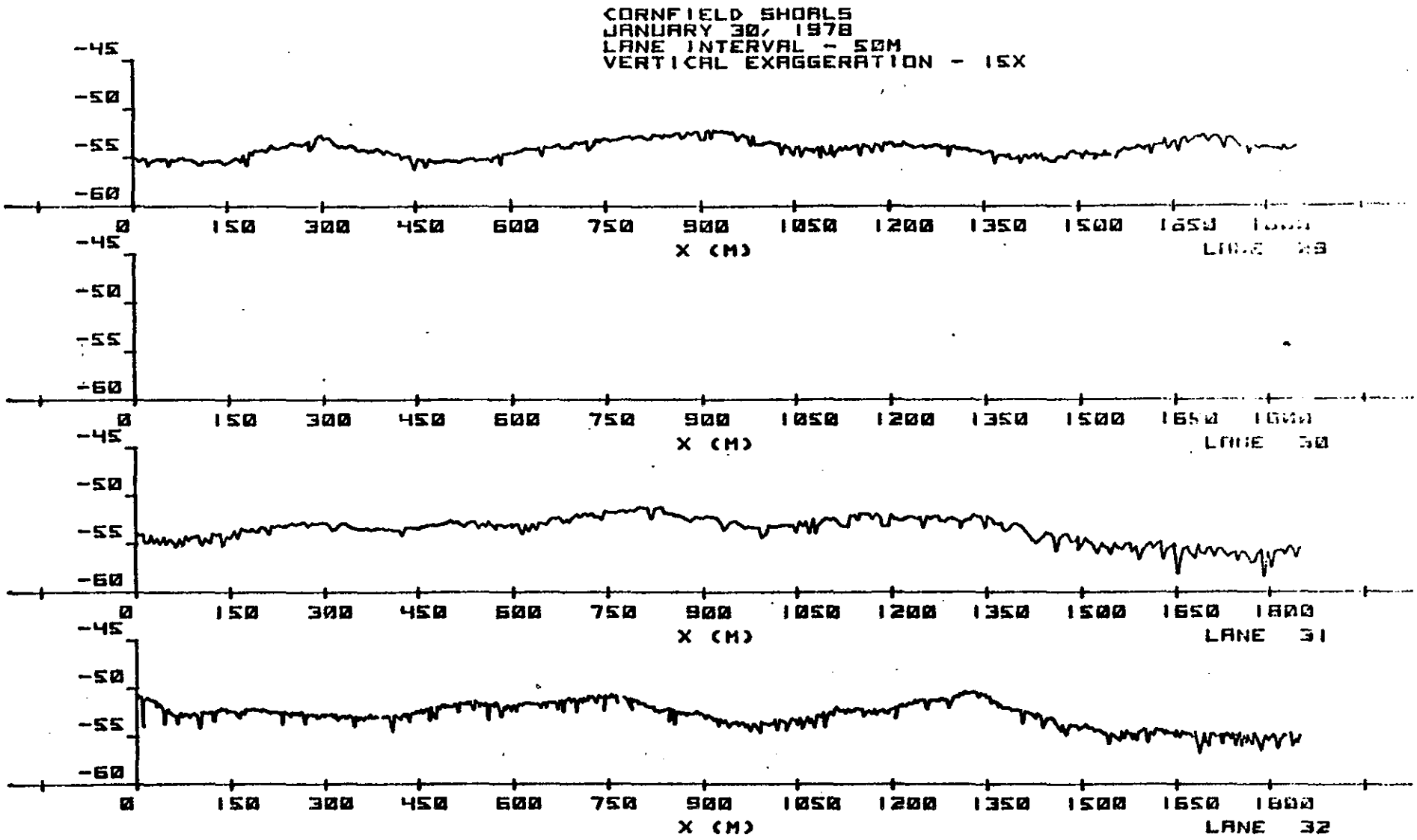

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 9
LANE 10
LANE 11
LANE 12


-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 13
LANE 14
LANE 15
LANE 16

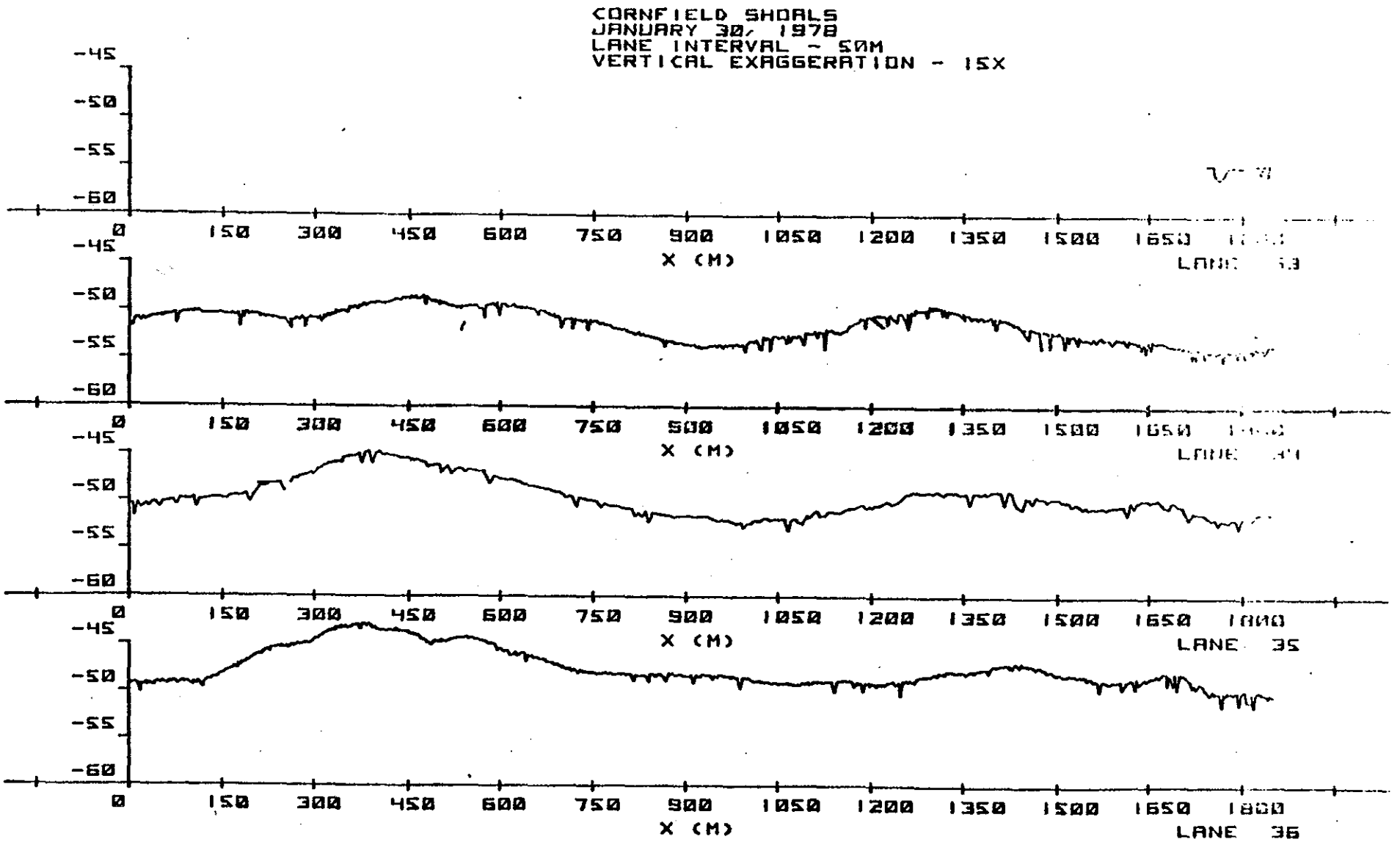

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
X (M)
LANE 17
LANE 18
LANE 19
LANE 20

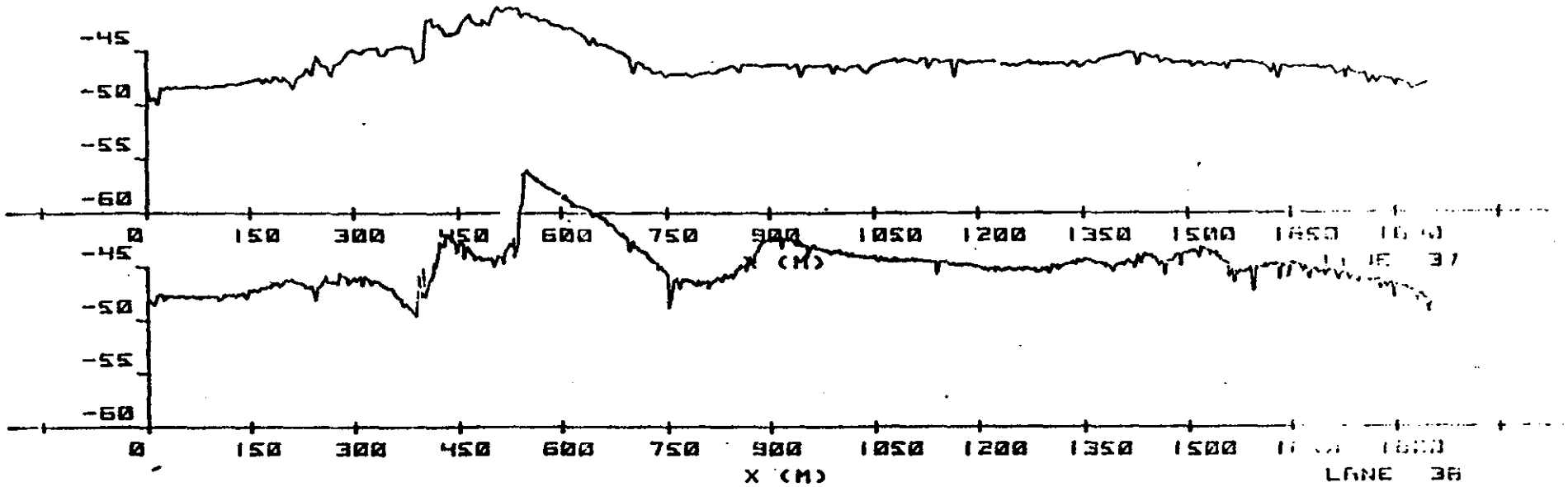

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
X (M)
LANE 21
LANE 22
LANE 23
LANE 24


CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 25
LANE 26
LANE 27
LANE 28

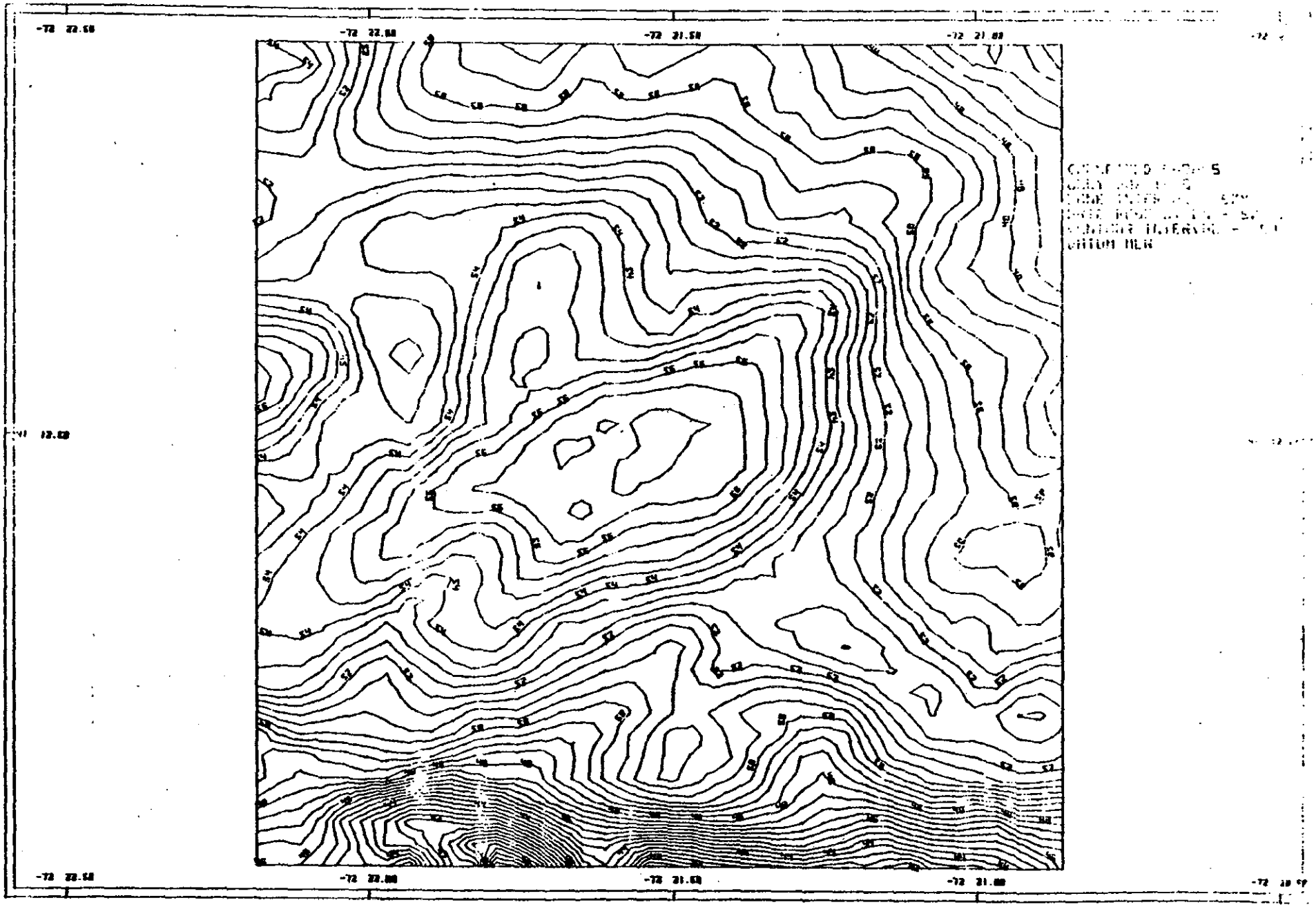

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 31
LANE 32

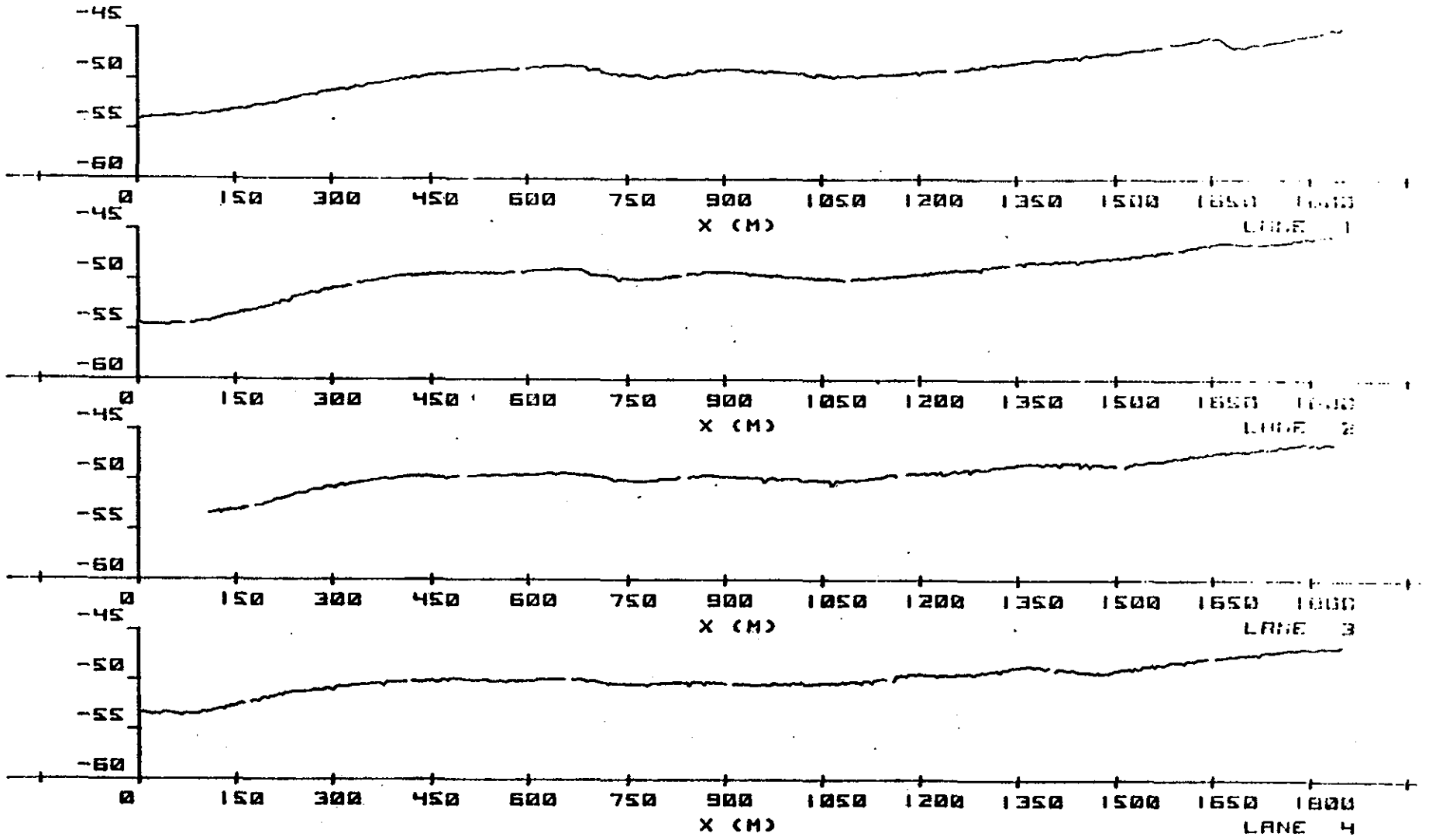
12-9

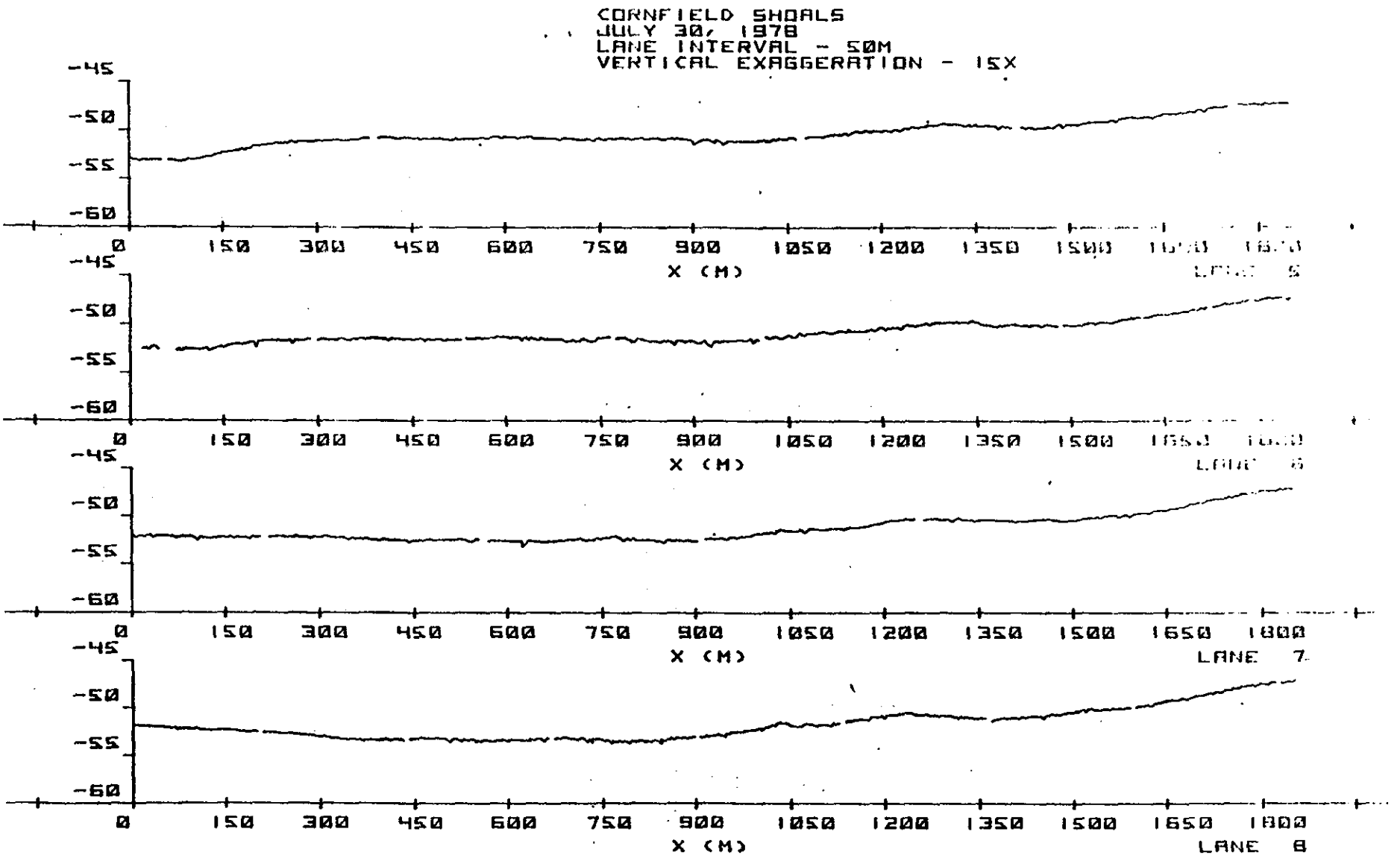

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 35
LANE 36

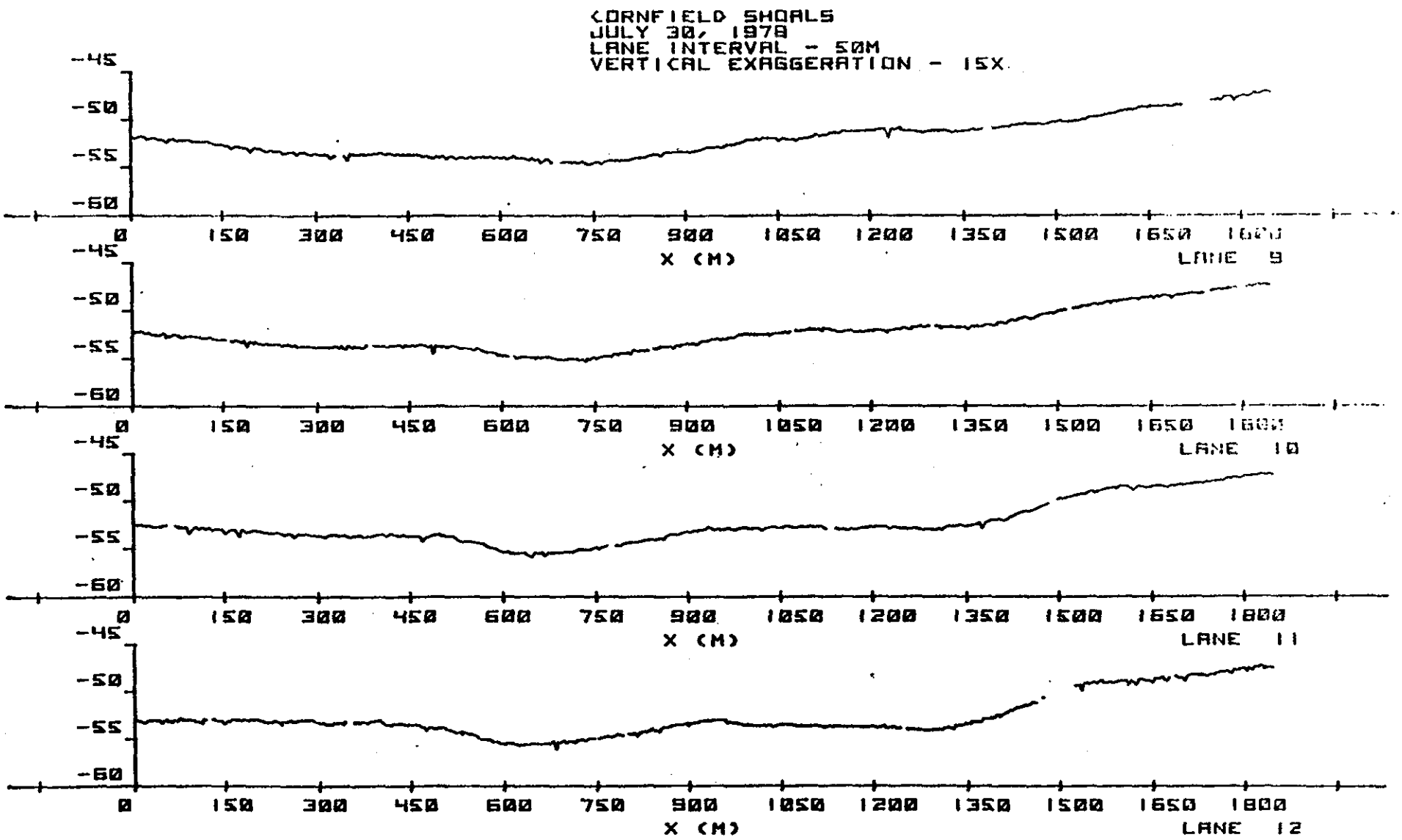

-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
X (M)
LANE 36

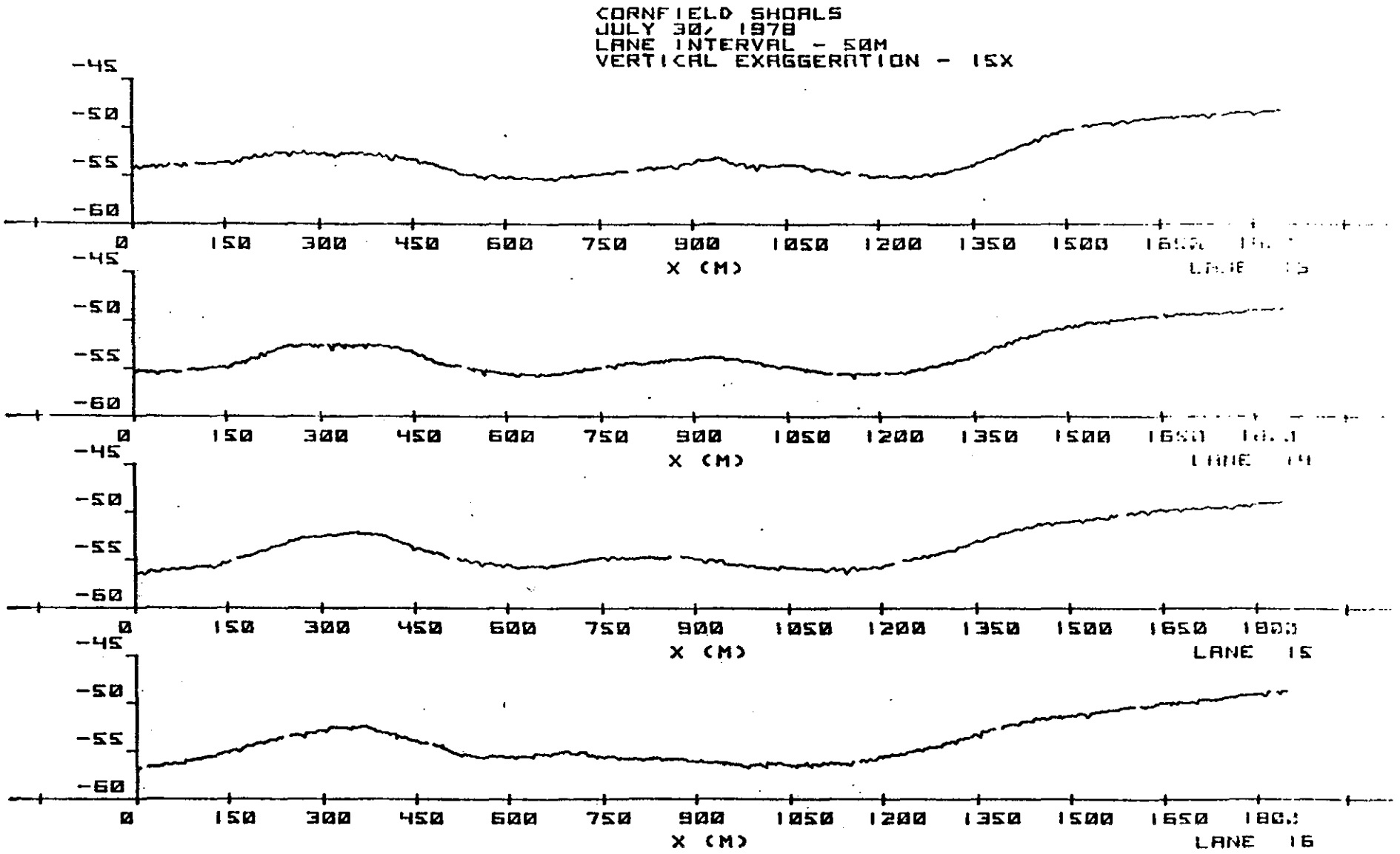
6.2K


-72 22.58
-72 22.00
-72 21.58
-72 21.00


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 1
LANE 2
LANE 3
LANE 4


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 7
LANE 8


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0 150 300 450 600 750 900 1050 1200 1350 1500 1650 1800
X (M)
LANE 9
LANE 10
LANE 11
LANE 12


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
X (M)
LANE 15
LANE 14
LANE 15
LANE 16

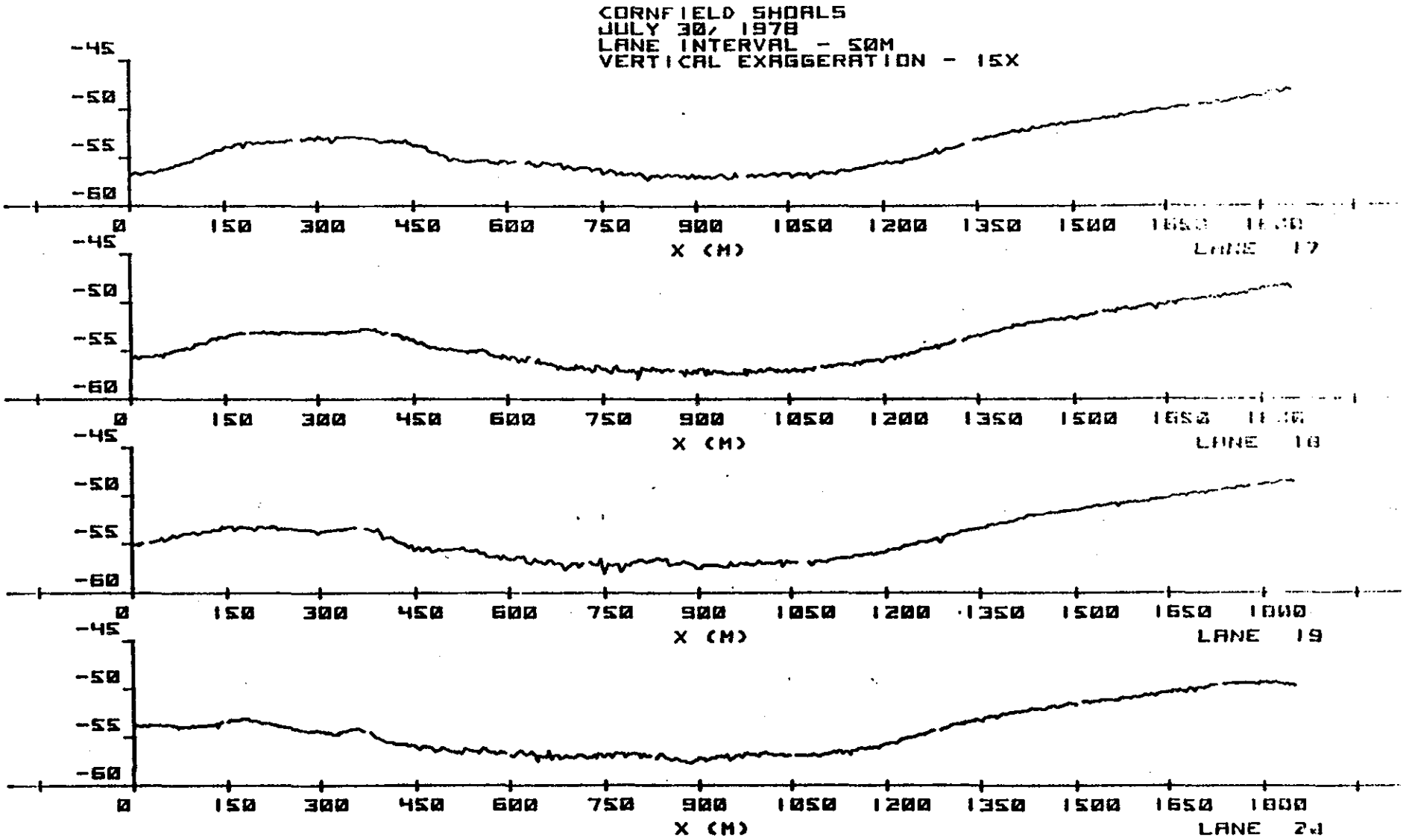
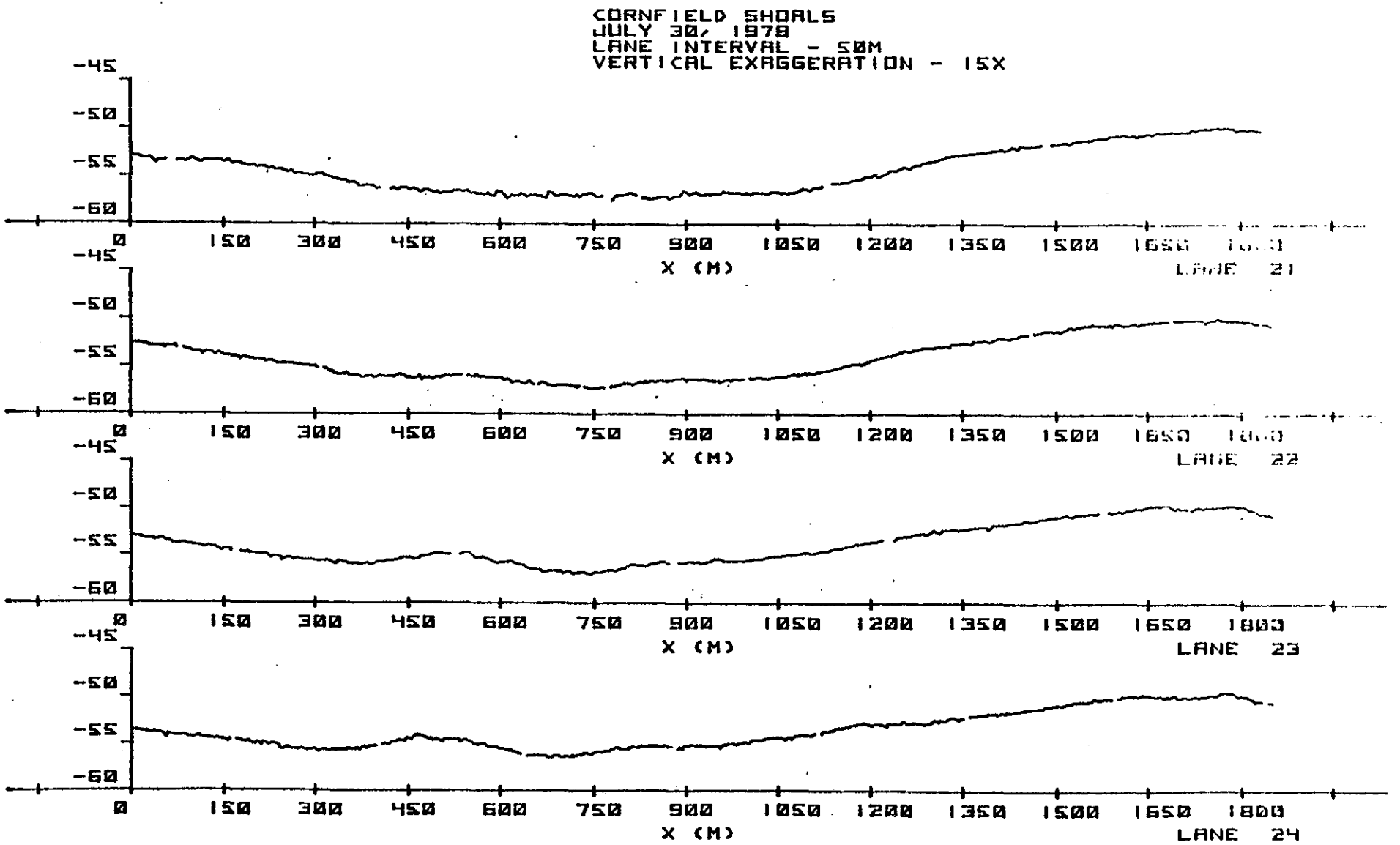
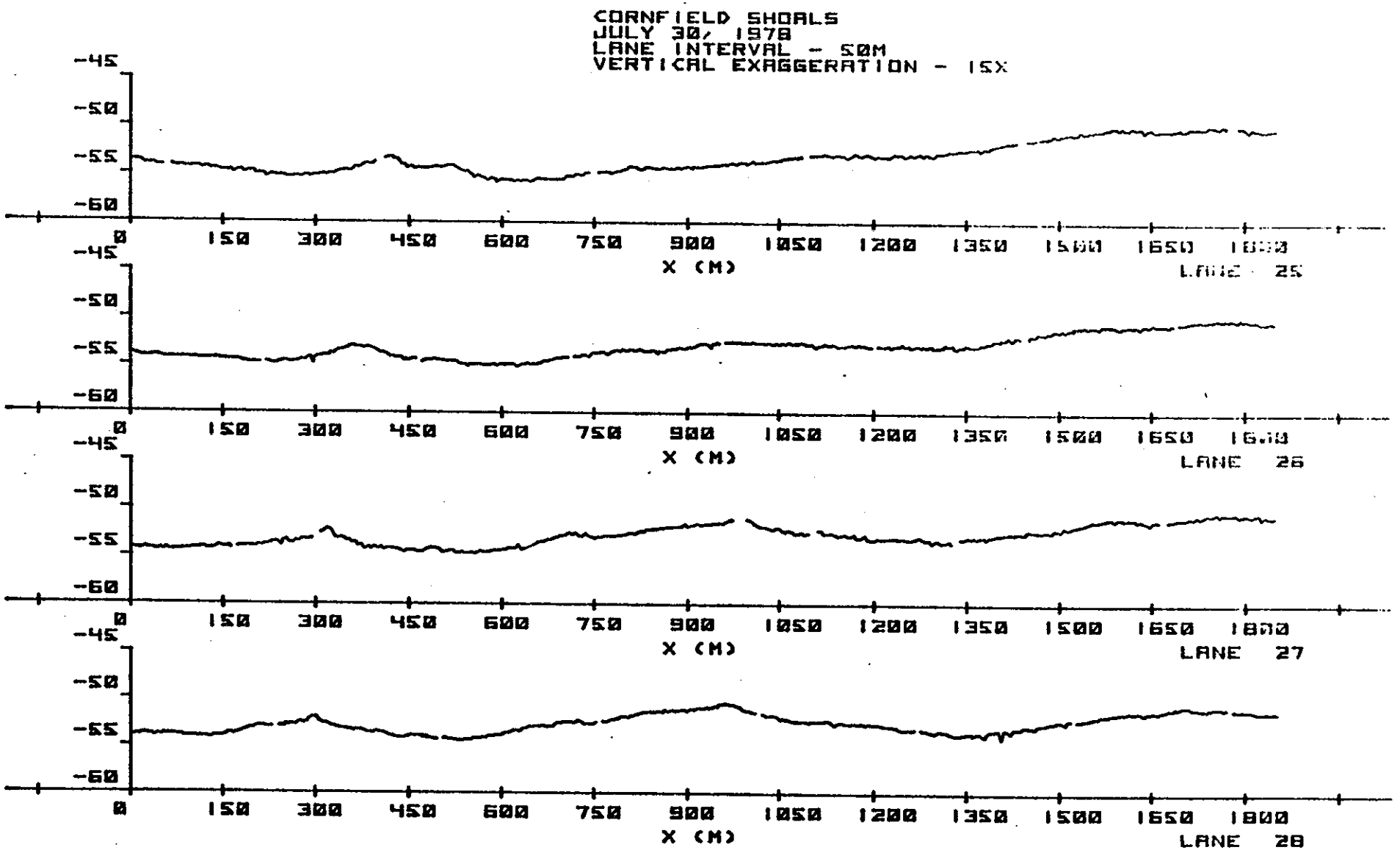
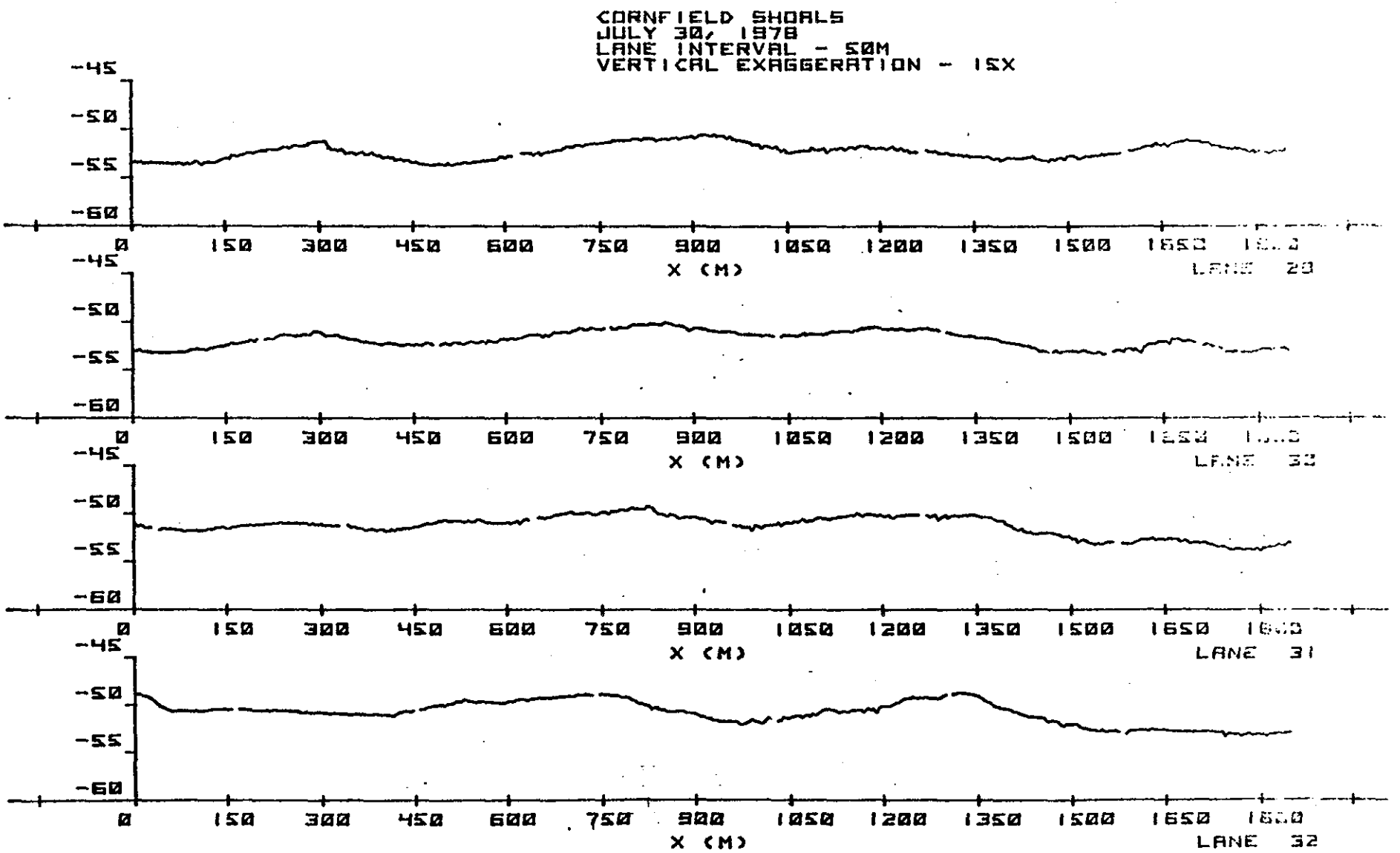

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 17
LANE 18
LANE 19
LANE 20

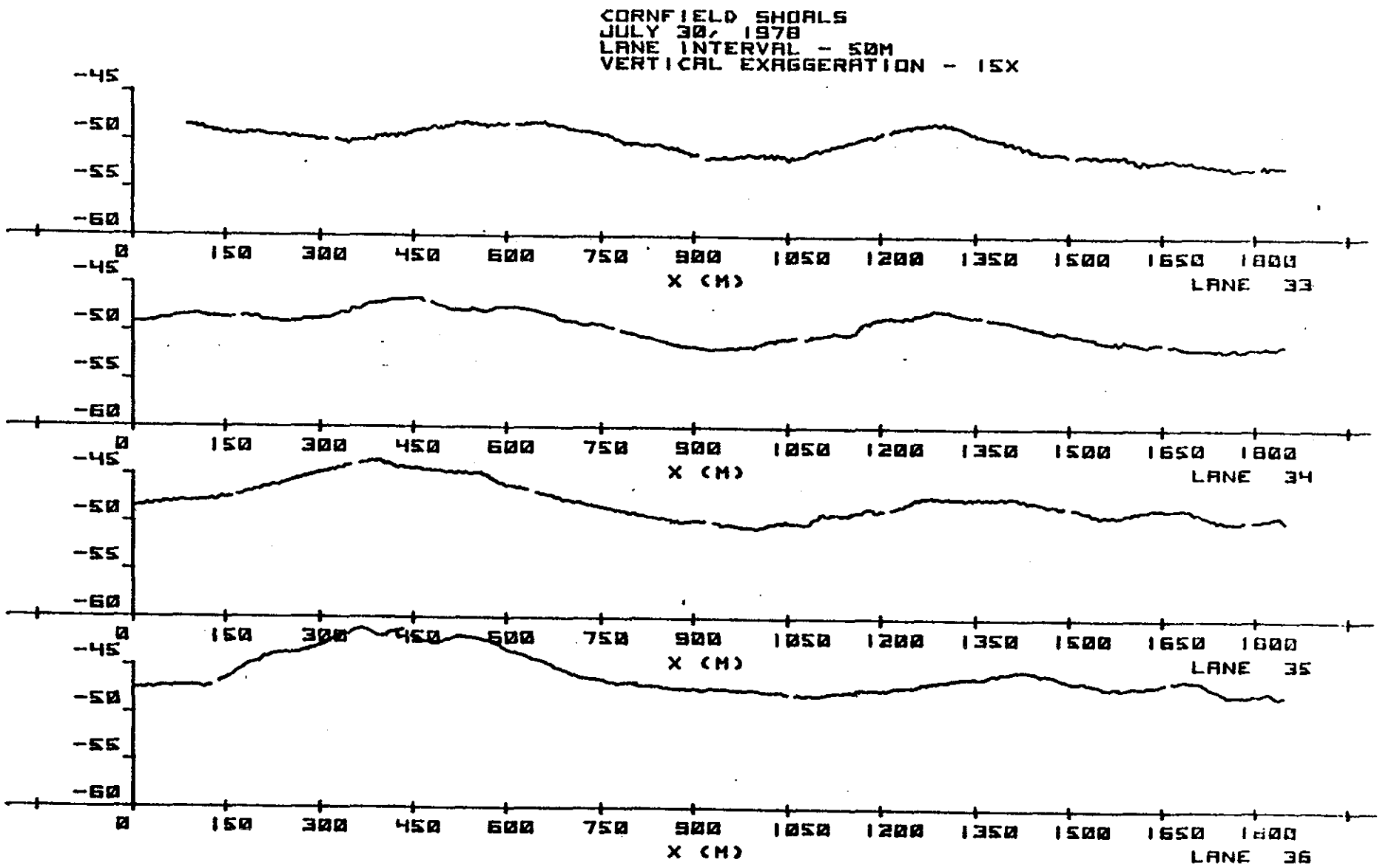
Fig. 9

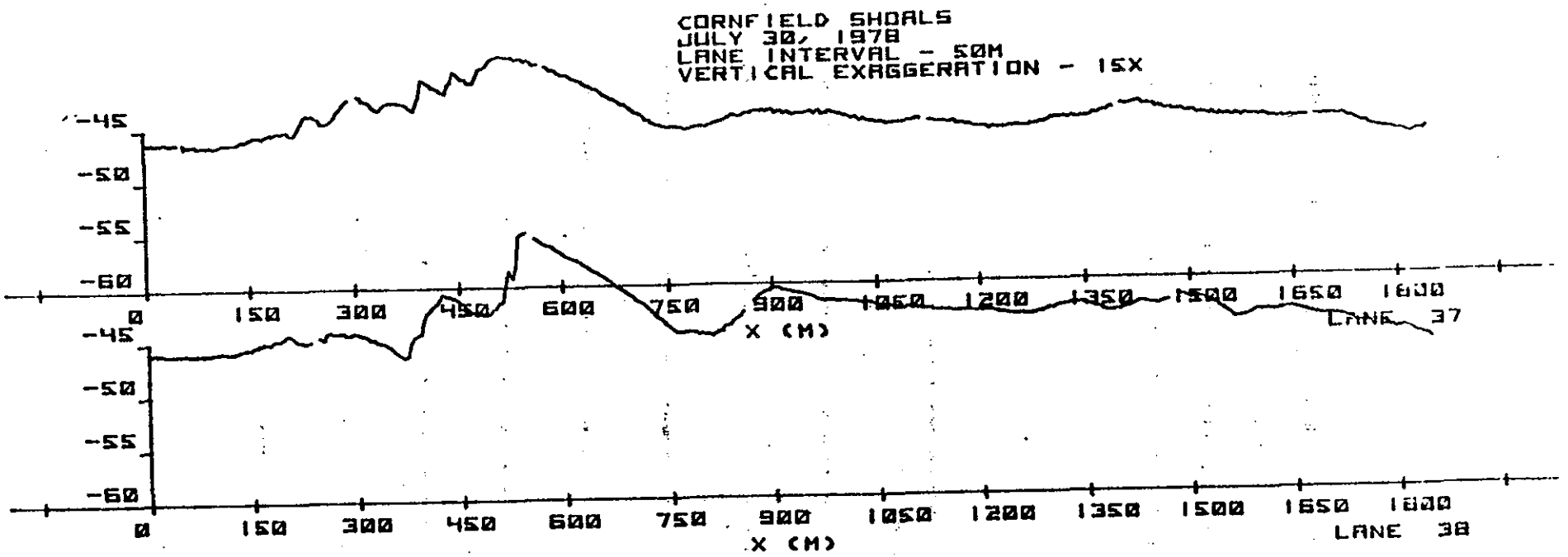

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
X (M)
LANE 21
LANE 22
LANE 23
LANE 24


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 25
LANE 26
LANE 27
LANE 28

H3-9


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
X (M)
LANE 29
LANE 30
LANE 31
LANE 32


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 33
LANE 34
LANE 35
LANE 36


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 37
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 38

G.3K

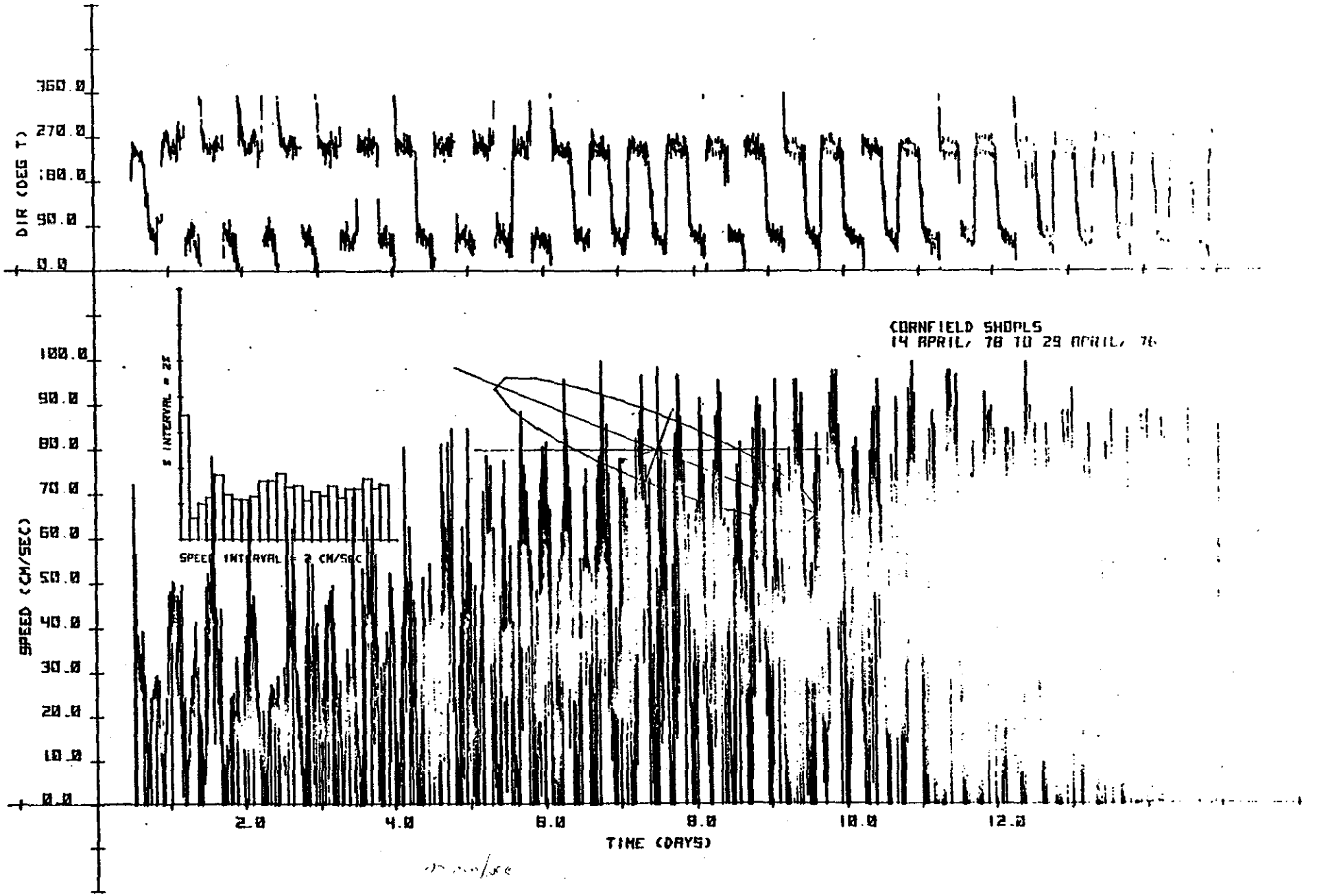
Currents

Current data for the Cornfield Shoals disposal site are presented in Figure G-4(a-d) and Table G-1. It is apparent from the speed-direction versus time record that the current meter was not operating in a normal manner. The data consists of spikes resulting from a misalignment of the tape head in the recording device, however, the tidal component of the current can be resolved from these data and is in fact presented in Table G-1.

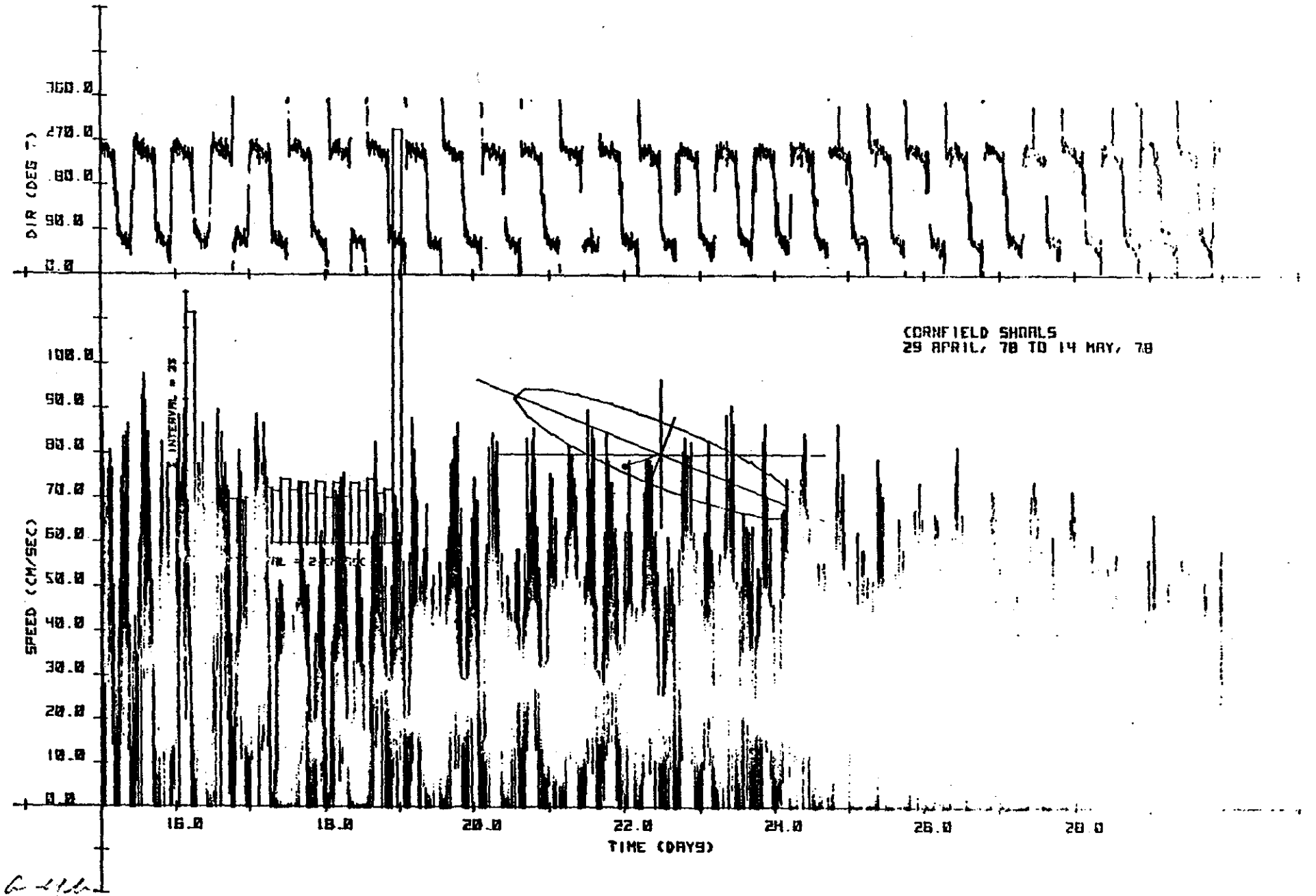
TABLE G-1

| | Total OBS. Current | Tidal Current Inc. Mean | Residual Current | Mean Current |
|---|---|---|---|---|
| Semi-major axis (cm/sec) | 33.7 | 22.73 (1.99) | 26.21 | - |
| Semi-minor axis (cm/sec) | 7.6 | 1.79 | 7.36 | - |
| Direction (°T) | 111 | 110 | 111 | - |
| Horizontal Kinetic energy (dynes/sec) | 595.95 | 259.89 | 370.57 | 34.59 |
| 10% Highest speeds (cm/sec) | N.A. | - | - | - |
| Peak speed (cm/sec) | - | 44.58 | - | - |
| Average maximum speed (cm/sec) | - | 32.24 (1.6a) | - | - |

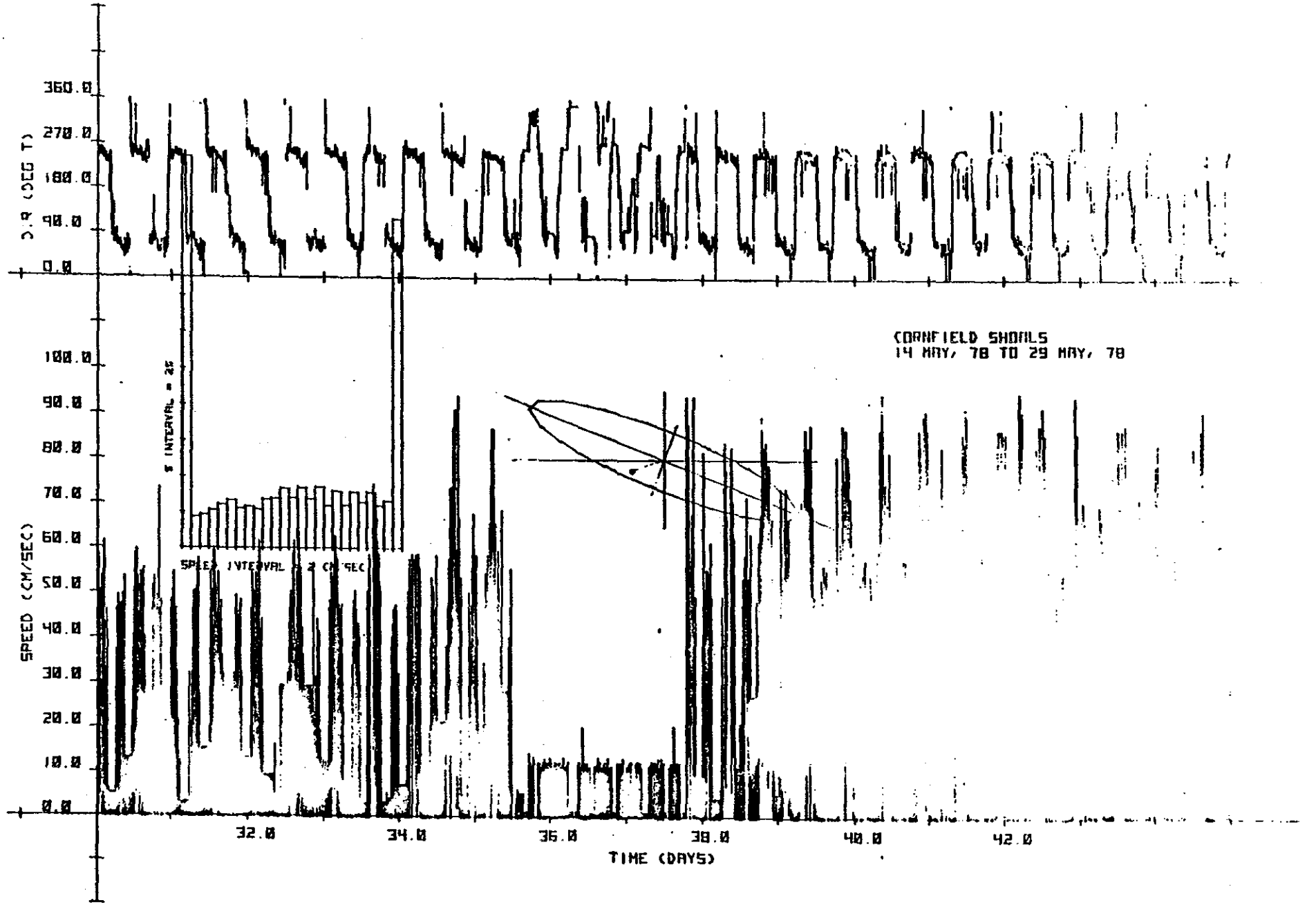
The tidal component of the current at Cornfield Shoals has a kinetic energy of 260 dynes/sec that is almost identical to the tidal energy at the New London


DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
CORNFIELD SHOALS
14 APRIL 78 TO 29 APRIL 78
SPEED (CM/SEC)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
TIME (DAYS)

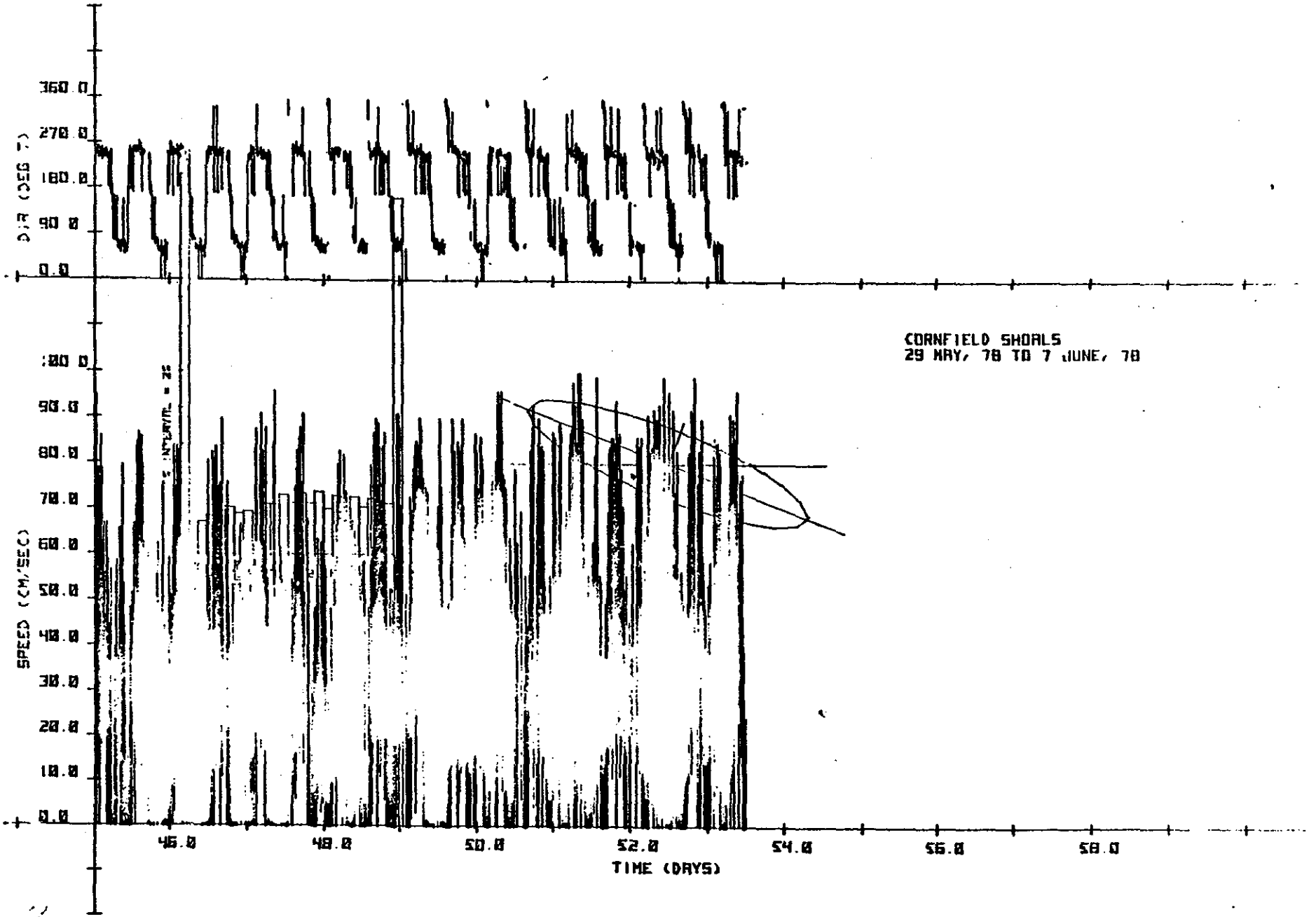
G.4.4


DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
CORNFIELD SHOALS
29 APRIL, 78 TO 14 MAY, 78
SPEED (CM/SEC)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
INTERVAL = 35
16.0
18.0
20.0
22.0
24.0
26.0
28.0
TIME (DAYS)

G-45


D.R (DEG T)
360.0
270.0
180.0
90.0
0.0
CORNFIELD SHOALS
14 MAY, 78 TO 29 MAY, 78
5 INTERVAL = 2S
SPEED INTERVAL = 2 CM/SEC
SPEED (CM/SEC)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
32.0
34.0
36.0
38.0
40.0
42.0
TIME (DAYS)

C-47


360.0
270.0
180.0
90.0
0.0
DIR (DEG T)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
SPEED (CM/SEC)
CORNFIELD SHOALS
29 MAY, 78 TO 7 JUNE, 78
46.0
48.0
50.0
52.0
54.0
56.0
58.0
TIME (DAYS)

site. Since, the spoils at New London are relatively stable, it is puzzling to find no physical evidence of spoils at Cornfield Shoals. It may be that the residual current component at Cornfield Shoals is significantly greater than that at New London, however, better data are required before that can be determined.

Sediments

Heavy metal analysis of sediments from the Cornfield Shoals disposal site are presented in Table G-2. Although most samples at this site are among the cleanest found in the entire New England study area, two samples from the point of dumping (Corn DS-2, from March and July) have extremely high concentrations and enrichment relative to iron. Thus, it is apparent that although no spoil mound has been formed at this site, spoils are present in the area as isolated patches. Future sampling will be oriented toward determing the extent and distribution of this spoil. The impact and extent of this and future dumping should be readily discernable because of the great difference in composition between spoils and surrounding sediments.

Biochemical Studies

At the Cornfield Shoals disposal site and reference station Mytilus edulis collected on January 16, 1978 from Latimer's Light were placed on the mussel cages and used to construct the 95% confidence limits for statistical analysis. The cage at the disposal site was located at 41° 12' 37.4"N, 72° 21'56"W and the reference station was located approximately 1 mile north of the site at 41° 13'44.1' N, 72° 22' 24.1" W in 30 meters of water south of Long Sand Shoal.

The baseline data from Latimer's Light and results obtained from samples at the sites are presented in Table G-3 and Figure G-5. With the exception of

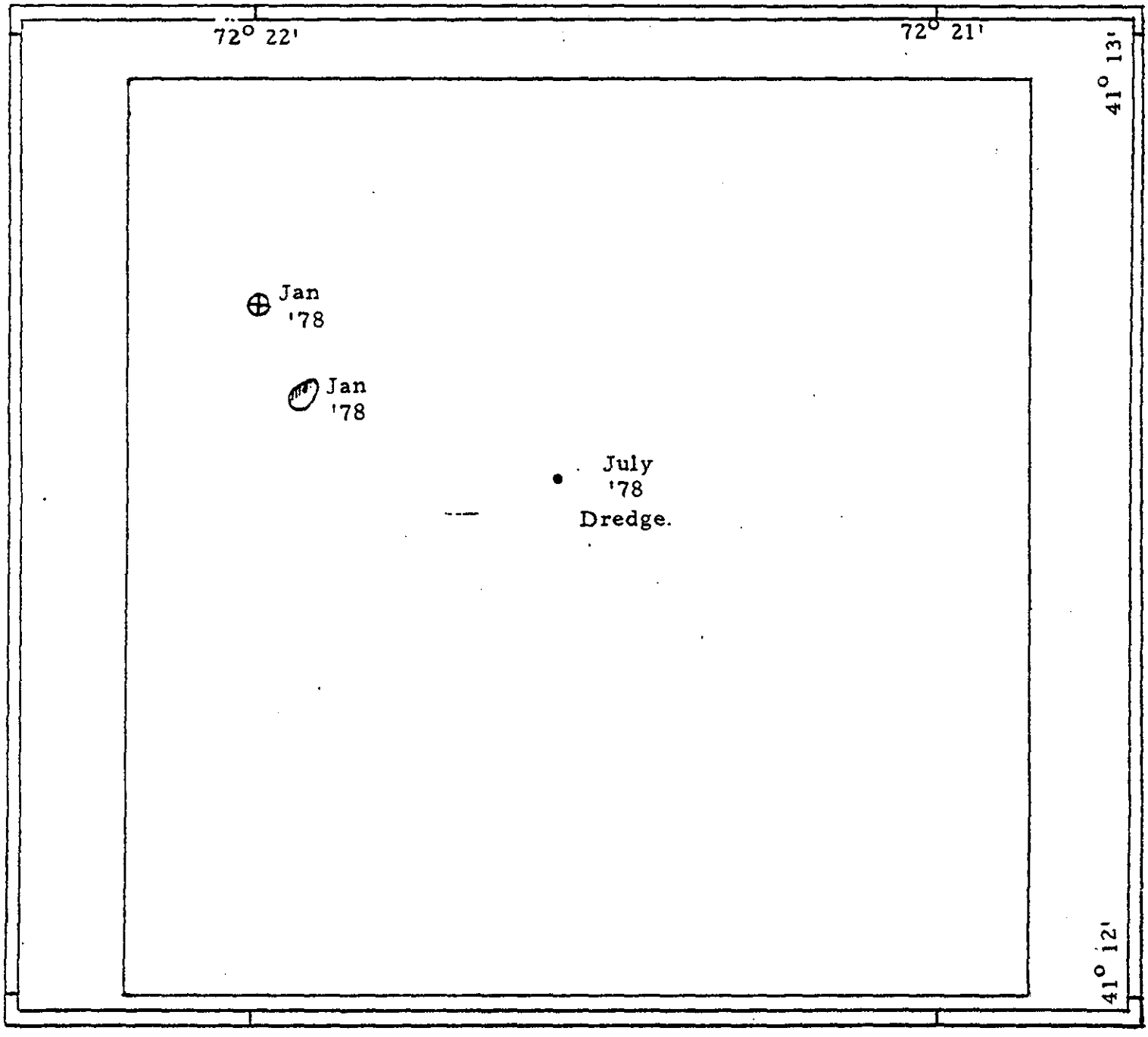
TABLE G-2a

SAMPLE LOCATIONS

SITE: Cornfield

| DATE | DISPOSAL SITE: CURRENT METER | MUSSELS | BENTHIC SAMPLES DREDGES | BENTHIC SAMPLES GRABS | REFERENCE SITE MUSSELS | BENTHIC SAMPLES DREDGES | BENTHIC SAMPLES GRABS |
|---|---|---|---|---|---|---|---|
| 31/July/1978 | | | 41°12'32.2"<br>72°21'36.6" | No Posit. | | 41°13'32.2"<br>72°22'11.8" | |
| 31/Jan/1978 | 41°12'43.3"<br>72°21'59.8" | 41°12'37.4"<br>72°21'56.0" | | | 41°13'44.1"<br>72°22'24.1" | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Cornfield Shoals




⊕ Current Meter  Mussell Cage  • Benthic Sample

TABLE G-2

SURFACE SEDIMENT ANALYSIS

CORNFIELD SHOAL CT.

| SAMPKING | Cd | Co | Cr | Cu | Fe* | Hg | Ni | Pb | Zn | Vol/Sol | Oil/Grease |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All metals ppm | | | | | | | | | (%) | (ppm x $10^3$) |
| MAR/APR 1978 | | | | | | | | | | | |
| CORN CS | .12 | 2.9 | 5.6 | 2.8 | .66 | .01 | 21 | 8.9 | 28 | .93 | .05 |
| CORN DS 1 dump | .11 | 2.6 | 8.1 | 4.3 | .45 | .07 | 18 | 4.5 | 28 | 1.1 | 7.6 |
| CORN DS 2 dump | 1.7 | 7.3 | 56 | 59 | 1.5 | .29 | 41 | 52 | 144 | 7.0 | 3.0 |
| CORN DS 3 dump | .12 | 5.3 | 6.3 | 4.6 | .82 | .04 | 38 | 14 | 35 | 5.2 | 1.4 |
| CORN NM 2 | .24 | 5.1 | 6.8 | 9.4 | .66 | .04 | 39 | 14 | 28 | 5.5 | .35 |
| CORN SM 4 | .25 | 3.7 | 6.3 | 5.8 | .62 | .02 | 21 | 11 | 24 | 2.7 | nil |
| CORN WM 5 | .12 | 2.9 | 6.5 | 4.0 | .42 | .16 | 13 | 5.8 | 22 | .9 | nil |
| ERROR % | 25 | 9 | 5 | 7 | 3 | 14 | 5 | 13 | 15 | 5 | 15 |
| JULY 1978 | | | | | | | | | | | |
| CORN 1 | .37 | 4.4 | 30 | 15 | 1.0 | .05 | 14 | 12 | 53 | 5.0 | .61 |
| CORN 2 | 4.0 | 8.5 | 93 | 82 | 1.6 | .64 | 31 | 83 | 281 | 24 | 6.3 |
| CORN Ref 1 | .25 | 2.4 | 11 | 1.7 | .56 | nil | 6.1 | 7.5 | 27 | 1.7 | .52 |

*All Fe values multiply by $10^4$

TABLE G-3. HEAVY METAL CONCENTRATIONS (PPM) IN *MYTILUS EDULIS* FROM LATIMER'S LIGHT DEPLOYED AT CORNFIELD SHOALS, NEW HAVEN, WLIS AND CABLE AND ANCHOR REEF DISPOSAL SITES (SOUTHERN NEW ENGLAND).

| DATE | LOCATION | | CD | CR | CU | HG | PB | ZN |
|---|---|---|---|---|---|---|---|---|
| 1-16-78 | LATIMER'S | $\bar{x}$ | 2.18 | 4.34 | 10.80 | 0.210 | 8.58 | 162 |
| | LIGHT | S.D. | 0.32 | 0.50 | 0.54 | 0.028 | 1.61 | 23 |
| 4-10-78 | | $\bar{x}$ | 2.06 | 7.71 | 8.53 | 0.199 | 5.17 | 110 |
| | | S.D. | 0.46 | 2.88 | 0.38 | 0.027 | 2.29 | 45 |
| 8-9-78 | | $\bar{x}$ | 1.37 | 2.45 | 8.68 | 0.169 | 5.52 | 112 |
| | | S.D. | | | | 0.009 | 1.44 | |
| 4-14-78 | CORNFIELD | $\bar{x}$ | 1.84 | 1.59 | 14.03 | 0.247 | 0.53 | 184 |
| | SHOALS | S.D. | 0.25 | 1.10 | 0.40 | 0.027 | 0.13 | 10 |
| | REFERENCE SITE | | | | | | | |
| 8-2-78 | | $\bar{x}$ | 1.80 | 2.84 | 8.03 | 0.165 | 1.47 | 144 |
| | | S.D. | 0.17 | | 0.44 | 0.014 | 1.48 | 38 |

TABLE G-4

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

CORNFIELD SHOAL DUMP SITE - 31 JANUARY 1978

| | PREDOMINANT SPECIES | DREDGE NUMBER #1 | #2 | #3 | TOTAL | MEAN | STANDARD DEVIATION | COEFF. OF DISPERSION | 95 PERCENT CONF. LIMITS OF MEAN | NUMERIC RANK | % OF TOTAL | CUMUL. % OF TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Anthozoan sp. | 0 | 0 | 5 | 5 | 1.7 | 2.9 | 4.9 | 0-8.9 | 1 | 55.6 | 55.6 |
| 2. | Anachis lafresnayi | 0 | 1 | 0 | 1 | 0.3 | 0.6 | 1.1 | 0-1.8 | 2 | 11.1 | 66.7 |
| 3. | Lunatia heros | 1 | 0 | 0 | 1 | 0.3 | 0.6 | 1.1 | 0-1.8 | 2 | 11.1 | 77.8 |
| 4. | Nassarius trivittatus | 0 | 0 | 1 | 1 | 0.3 | 0.6 | 1.1 | 0-1.8 | 2 | 11.1 | 88.9 |
| 5. | Urosalpinx cinerea | 0 | 1 | 0 | 1 | 0.3 | 0.6 | 1.1 | 0-1.8 | 2 | 11.1 | 100.0 |
| | TOTAL | 1 | 2 | 6 | 9 | 3.0 | 2.6 | 2.3 | 0-9.5 | | | |
| | TOTAL # OF SPP PER DREDGE | 1 | 2 | 2 | 5 | 1.7 | 0.6 | | 0.2-3.2 | | | |
| | SPECIES DIVERSITY (H') | 0 | 0.69 | 0.45 | 1.14 | 0.38 | 0.35 | | | | | |
| | EQUITABILITY (J') | 0 | 1.00 | 0.65 | 1.65 | 0.55 | 0.51 | | | | | |

TOTAL # OF INDIVIDUALS THIS STATION = 9

TABLE G-5

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

CORNFIELD SHOAL REFERENCE STATION - 31 JANUARY 1978

| | PREDOMINANT SPECIES | DREDGE NUMBER #1 | #2 | #3 | TOTAL | MEAN | STANDARD DEVIATION | COEFF. OF DISPERSION | 95 PERCENT CONF. LIMITS OF MEAN | NUMERIC RANK | % OF TOTAL | CUMUL. % OF TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Mytilus edulis | 0 | 0 | 18 | 18 | 6.0 | 10.4 | 18.0 | 0-31.8 | 1 | 20.2 | 20.2 |
| 2. | Nassarius trivittatus | 0 | 12 | 5 | 17 | 5.7 | 6.0 | 6.4 | 0-20.6 | 2 | 19.1 | 39.3 |
| 3. | Anachis lafresnayi | 0 | 0 | 7 | 7 | 2.3 | 4.0 | 7.1 | 0-12.2 | 3 | 7.9 | 47.2 |
| 4. | Crepidula plana | 0 | 0 | 5 | 5 | 1.7 | 2.9. | 4.9 | 0- 8.9 | 4 | 5.6 | 52.8 |
| 5. | Pherusa affinis | 0 | 0 | 3 | 3 | 1.0 | 1.7 | 3.0 | 0- 5.2 | 5 | 3.4 | 56.2 |
| 6. | Pagurus longicornis | 0 | 0 | 3 | 3 | 1.0 | 1.7 | 3.0 | 0- 5.2 | 5 | 3.4 | 59.6 |
| 7. | Echinarachnius parma | 0 | 3 | 0 | 3 | 1.0 | 1.7 | 3.0 | 0- 5.2 | 5 | 3.4 | 63.0 |
| 8. | Tellina agilis | 0 | 0 | 2 | 2 | 0.7 | 1.2 | 1.9 | 0- 3.7 | 6 | 2.2 | 65.2 |
| 9. | Unicola irrorata | 0 | 0 | 2 | 2 | 0.7 | 1.2 | 1.9 | 0- 3.7 | 6 | 2.2 | 67.4 |
| 10. | Amphipolis squamata | 0 | 0 | 2 | 2 | 0.7 | 1.2 | 1.9 | 0- 3.7 | 6 | 2.2 | 69.6 |
| | TOTAL | 0 | 15 | 47 | 62 | 20.7 | 24.0 | 27.8 | 0-80.3 | | | |
| | TOTAL # OF SPP PER DREDGE | 0 | 2 | 18 | 18 | 6.7 | 9.9 | | 0-31.2 | | | |
| | SPECIES DIVERSITY (H') | 0 | 0.50 | 2.33 | 2.83 | 0.94 | 1.23 | | | | | |
| | EQUITABILITY (J') | 0 | 0.72 | 0.81 | 1.53 | 0.51 | 0.44 | | | | | |

TOTAL # OF INDIVIDUALS THIS STATION = 89

Cr and Cu which show a significant increase in their concentrations during April 1978, there is no discernable change in the concentrations of Cd, Hg, and Zn. However, significant decreases are observed in the concentrations of Pb (disposal area) and Cr (disposal and reference area) for the April and August samples.

Benthic Macrofauna

Tables G-4 and G-5 present numeric density data for the Cornfield Shoals disposal site and reference station. Obviously the lack of individuals at the disposal site prohibits use of these data for more than a cursory look at the population. It may be that patchiness in the benthic population has biased these results.

Fisheries

Since no lobster buoys or commercial or sport fishing activity have been seen at this site during DAMOS investigations it was given low priority for fisheries mapping. Mapping will be completed during the next month along with the New London site.

Pratt (1977) found beds of blue mussels on the stable bottoms of the dump site and central depressions. Many other invertebrates took advantage of the food and shelter which these beds offer. Lobsters and finfish would find abundant food here and it is possible that fisheries are carried out during some part of the year.

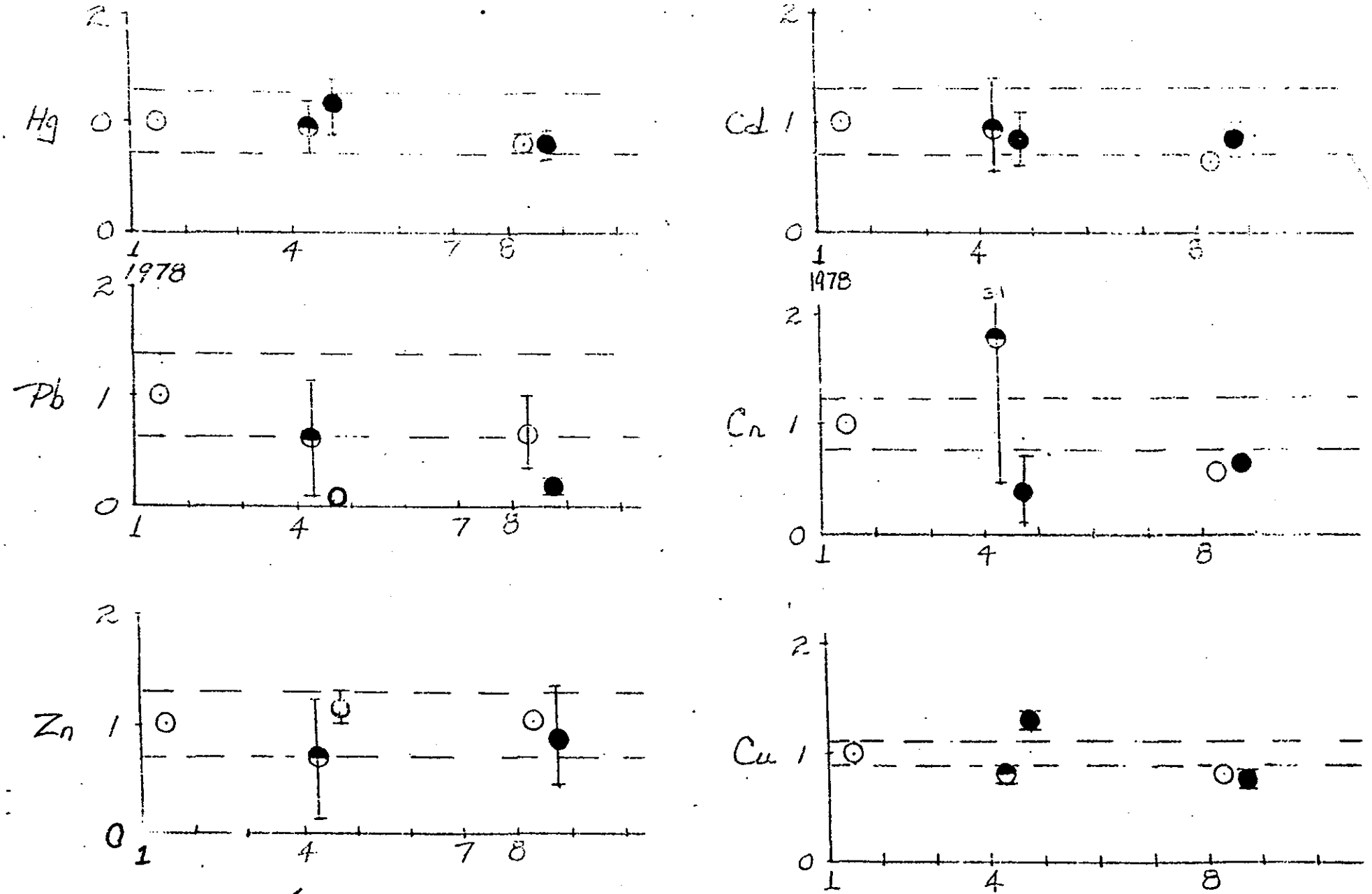



**Figure 6-6.** Temporal variation in the ratios of heavy metals in Mytilus edulis from Latimer's Light (O) deployed at Cornfield Shoals reference site (O). Broken lines represent the 95% confidence limits of the baseline data.